

## Repair Manual

Golf Variant 2007 ➤  
Golf Variant 2010 ➤  
Jetta 2005 ➤

### 4-Cylinder Fuel Injection Engine (2.0L Engine, Chain Drive)

Engine ID	CBF A	CCT A							
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Edition 10.2022



## List of Workshop Manual Repair Groups

### Repair Group

- 00 - General, Technical Data
- 10 - Engine Assembly
- 13 - Crankshaft, Cylinder Block
- 15 - Cylinder Head, Valvetrain
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- 20 - Fuel Supply
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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## 00 – General, Technical Data

### 1 General Information

(Edition 10.2022)

MEX5R0089.21 -- 10.2022 -- 11/1/2022-- JY

⇒ [f1.1 or Clean Working Conditions", page 1](#)

⇒ [P1.2 recautions", page 2](#)

#### 1.1 Guidelines for Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to the following "5 rules" for cleanliness:

- Thoroughly clean the connecting points and the surrounding area before loosening.
- Place the removed parts on a clean surface and cover them. Only use lint-free cloths.
- Carefully cover or seal opened components if the repair is not performed immediately.
- Install only clean parts: remove the replacement parts from their packaging just before installing them. Do not use parts that have been loosely stored (for example in tool boxes etc.).
- When the fuel system is open: avoid working with compressed air if possible. If possible do not move vehicle.



## 1.2 Safety Precautions

⇒ **P1.2.1 recautions, Working on Fuel Supply System", page 2**

⇒ **i1.2.2 n Pressure in the High Pressure Area", page 3**

### 1.2.1 Safety Precautions, Working on Fuel Supply System



#### WARNING

- ◆ *Follow the safety precautions when releasing the pressure in the high pressure area. Refer to ⇒ **P1.2 recautions", page 2**.*
- ◆ *The fuel system is under pressure! Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.*
- ◆ *Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.*

*For safety reasons, switch off the current to the fuel pump before opening the fuel system. Otherwise the fuel pump will be activated when the driver door is opened. Switch the power supply off in one of the following ways:*

- ◆ *Disconnect the battery.*

*or*

- ◆ *Remove the fuse for the Fuel Pump Control Module -J538-*

*or*

- ◆ *Disconnect the connector on the fuel delivery unit flange or on the Fuel Pump Control Module -J538-.*



#### Caution

*When doing any assembly work, especially in the engine compartment, pay attention to the following due to the limited space.*

- ◆ *Route lines of all types (for example for fuel, hydraulic, Evaporative Emission (EVAP) canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.*

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- Do not touch or disconnect Ignition Coils with Power Output Stages when engine is running or turning at starting RPM.
- The ignition must be switched off before connecting or disconnecting the fuel injection and ignition system lines and tester cables.
- The battery must only be disconnected and connected when the ignition is switched off, or else it could damage the



Engine Control Module. Obtain radio code for radios with anti-theft coding before disconnecting battery.

- Perform the necessary procedures after connecting the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27; Battery; Battery, Disconnecting and Connecting.

**Always pay attention to the following when removing and installing the Fuel Level Sensor or the Fuel Pump (fuel delivery unit) from full or partially filled fuel tanks.**

- Right before starting work, switch the exhaust extracting system on and place a suction hose close to the fuel tank installation opening to extract fuel fumes. If no exhaust extracting system is available, a radial fan (as long as the motor is not in air stream) with a delivery volume greater than 15 m<sup>3</sup>/h can be used.
- Do not let fuel come in contact with skin. Wear fuel-resistant gloves.

**If special testing equipment is required during a road test, pay attention to the following:**

- Test and measuring instruments must be secured to rear seat and operated by a second person from this location.
- If the vehicle is involved in a collision while testing and measuring equipment is operated from the front passenger seat, the person sitting in that seat could be seriously injured when the airbag deploys.

### 1.2.2 Decrease in Pressure in the High Pressure Area

**Special tools and workshop equipment required**

- ◆ Elbow Assembly Tool -T10118-

**Procedure**



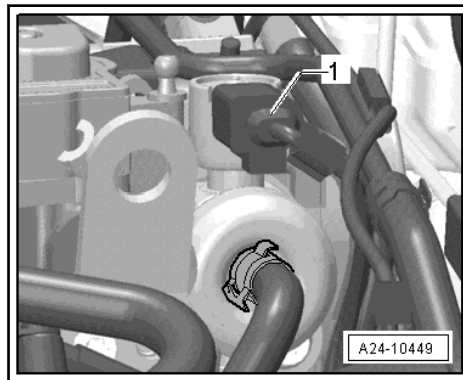
#### **WARNING**

*The injection system is divided into a high pressure area (maximum approximately 120 bar (1740 psi)) and a low pressure area (approximately 6 bar (87 psi)).*

- ◆ *Before opening high pressure area when, for example, removing the high pressure pump, fuel rail, Fuel Injectors, fuel pipes or Fuel Pressure Sensor -G247-, the fuel pressure in the high pressure area must be reduced to a residual pressure of approximately 6 bar (87 psi) The procedure for this is as follows.*

- Using the Elbow Assembly Tool -T10118-, remove the connector -1- from the Fuel Pressure Regulator Valve -N276-.





- Allow engine to idle for approximately 10 seconds.



#### Note

- ◆ *When the Fuel Pressure Regulator Valve -N276- electrical connector is disconnected during idle, pressure in high pressure area decreases to approximately 6 bar (87 psi).*
  - ◆ *After the high pressure has been released, the high pressure system must be opened, otherwise the pressure increases again due to the warming of the fuel.*
- Switch off the ignition.



#### WARNING

**Fuel lines are pressurized!**

- ◆ *For safety reasons, interrupt the current supply to the fuel pump. Refer to ⇒ **P1.2.1 precautions, Working on Fuel Supply System**, page 2 before opening the fuel system because the fuel pump is activated by the driver door contact switch.*
  - ◆ *Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.*
  - ◆ *Before opening the high pressure system, place a cloth around the connection.*
- Place a clean cloth around the connection point and carefully open to release the residual pressure of approximately 6 bar (87 psi). Escaping fuel must be absorbed.



#### Note

*By separating the connections, Diagnostic Trouble Codes (DTCs) will be stored. After assembling, check the fault memory and erase, if necessary.*

- Check the Engine Control Module DTC memory and erase any entries using Vehicle Diagnostic Tester “Guided Function”.





#### Note

*If the DTC memory was erased, the readiness code must be re-generated using the Vehicle Diagnostic Tester in "Guided Fault Finding" function.*

### 1.2.3 Decrease in pressure in the high pressure area (engine code CCZA)



#### WARNING

*The fuel injection system is separated into a high-pressure section where the pressure is a maximum of approximately 120 bar and a low-pressure section where the pressure is approximately 6 bar.*

*Before opening the high pressure area, for example to remove the Fuel Pressure Sensor -G247-, the fuel pressure must be reduced to a residual pressure of approximately 6 bar. The procedure for this is as follows.*

- Connect the Vehicle Diagnostic Tester and perform the "Reduce fuel high pressure" Guided Function.  
Switch off the ignition.



#### WARNING

**Fuel lines are pressurized!**

- ◆ *For safety reasons, interrupt the current supply to the fuel pump: (refer to ➤ **P1.2.1 precautions, Working on Fuel Supply System**, page 2) before opening the fuel system because the fuel pump is activated by the driver door contact switch. Wear both safety glasses and protective clothing to prevent injury and contact with skin.*
- ◆ *Before opening the high pressure system, place a cloth around the connection.*

- Place a clean cloth around the connection point and carefully open to release the residual pressure of approximately 6 bar. Escaping fuel must be absorbed.
- To complete the procedure, check the engine control module DTC memory and erase all memory entries.



#### Note

*If the DTC memory was erased, the readiness code must be re-generated using the Vehicle Diagnostic Tester in "Guided Fault Finding" function.*



## 2 Specifications

⇒ **N2.1 Number/Engine Characteristics", page 6**

### 2.1 Engine Number/Engine Characteristics

#### Engine Number

- ◆ The engine number ("Engine Code" and "Serial Number") are located at the front of the engine/transmission joint.
- ◆ There is also a label located on the upper timing chain cover with the "Engine Code" and "Serial Number".
- ◆ The engine code letters are also located on the vehicle data plate.
- ◆ The vehicle data label is located in both the customer service plan and on the vehicle rear in the spare tire well or on the luggage compartment floor.
- ◆ The engine number consists of up to nine characters (alphanumeric).
- ◆ The first part (maximum four letters) represents the "Engine Code", the second part (six digit) is the "Serial Number".
- ◆ If more than 999,999 engines with the same engine code are produced, the first of the six characters is replaced with a letter.

#### Vehicles with Four-Digit Engine Codes

- ◆ Four-letter engine codes beginning with "C" are used.
- ◆ The first three letters describe the mechanical engine structure and are still stamped on the engine, as before.
- ◆ The fourth letter describes the engine torque and output and depends on the Engine Control Module.
- ◆ The four-letter engine code is on the type label, the vehicle data label and the Engine Control Module.



#### Note

*Vehicles for some countries do not have a type label. Installed locations for the vehicle data sticker and the type label. Refer to ⇒ Maintenance; Booklet 20.1.*

#### Engine Data

Codes		CBFA	CCTA
Manufactured		From 11/2007	From 11/2007
Emissions values	Standard	SULEV	ULEV 2
Displacement	liters	2.0	2.0
Output	kW at 1/RPM	147/5100	147/5100
Torque	Nm at 1/RPM	280/1700	280/1700
Hole	diameter in mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		9.6:1	9.6:1
Valves per cylinder		4	4
Research Octane Number (RON)		minimum 95	minimum 95



Codes	CBFA	CCTA
Fuel injection and ignition system	FSI	FSI
Ignition sequence	1-3-4-2	1-3-4-2
On Board Diagnostics (OBD)	yes	yes
Knock control	1 Knock sensor	1 Knock sensor
Catalytic Converter	yes	yes
Oxygen sensor regulation	3 sensors	2 sensors
Exhaust Gas Recirculation (EGR)	no	no
Turbocharger	Turbocharger	Turbocharger
Intake manifold change-over	yes	yes
Camshaft adjustment	yes	yes
Secondary Air Injection (AIR) system	yes	no
Valves per cylinder	4	4
Oil pressure control	no	no

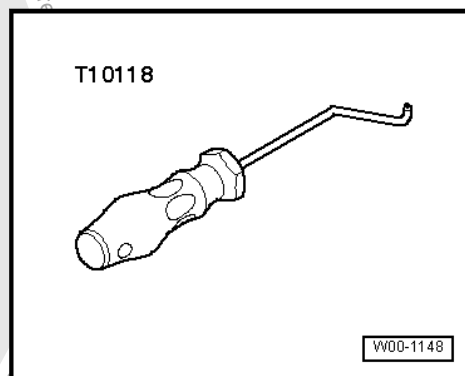




### 3 Special Tools

#### Special tools and workshop equipment required

- ◆ Elbow Assembly Tool -T10118-





## 10 – Engine Assembly

### 1 Description and Operation

⇒ [-1.1 Subframe Mount", page 9](#)

⇒ [M1.2 Mount, Adjusting", page 11](#)

#### 1.1 Overview - Subframe Mount



## 1 - Bolt

Tightening specification:

- ☐ Vehicles with a manual transmission. Refer to ➤ Manual Transmission; Rep. Gr. 34; Description and Operation.
- ☐ Vehicles with a DSG® transmission. Refer to ➤ Direct Shift Gearbox; Rep. Gr. 34; Description and Operation.
- ☐ Transmission support to transmission

## 2 - Bolts

- ☐ 50 Nm + 90°
- ☐ Always replace
- ☐ Pendulum support to transmission

## 3 - Engine Support

### 4 - Bolt

- ☐ 40 Nm + 180°
- ☐ Always replace
- ☐ Engine support to engine

## 5 - Engine Mount

### 6 - Bolt

- ☐ 40 Nm + 90°
- ☐ Always replace
- ☐ Engine mount to body

## 7 - Bracket

### 8 - Bolt

- ☐ 20 Nm + 90°
- ☐ Always replace
- ☐ Bracket to engine mount

### 9 - Bolt

- ☐ 20 Nm + 90°
- ☐ Always replace
- ☐ Bracket to body

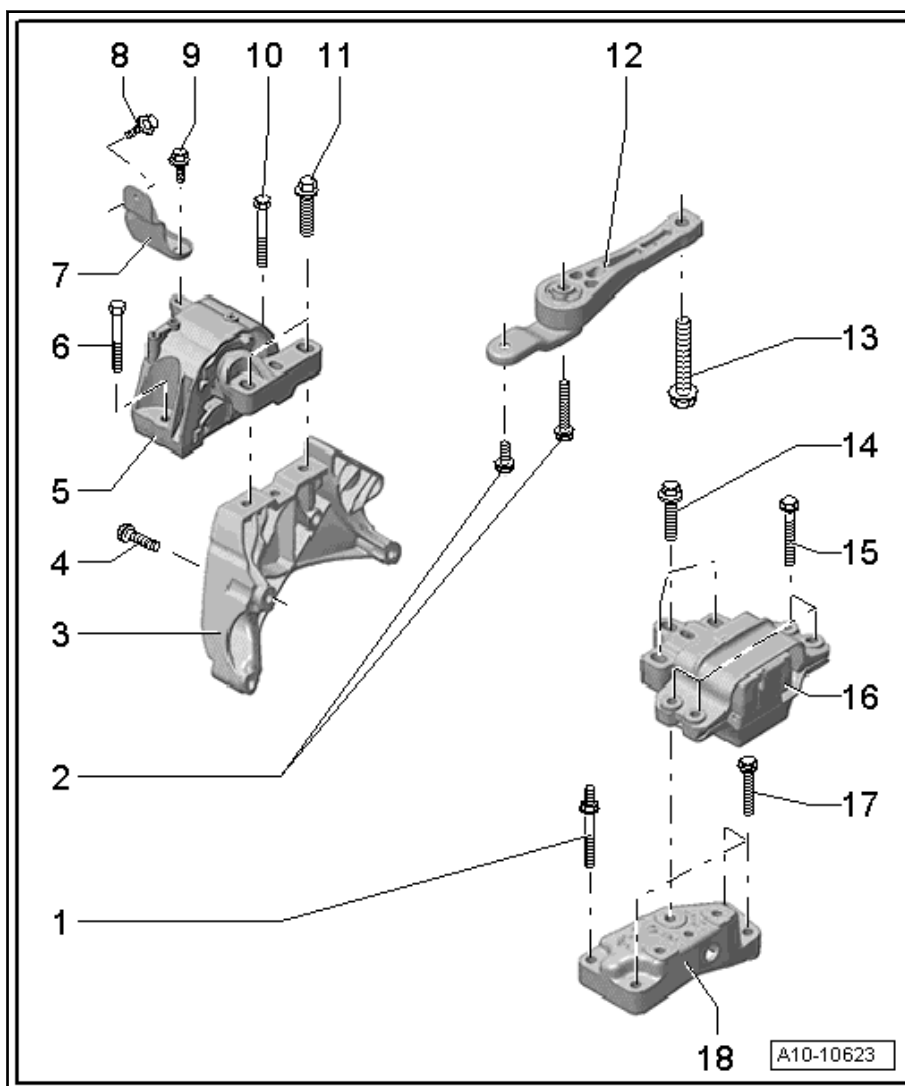
### 10 - Bolt

- ☐ 40 Nm + 90°
- ☐ Always replace
- ☐ Engine mount to body

### 11 - Bolts

- ☐ 60 Nm + 90°
- ☐ Always replace
- ☐ Engine mount to engine support

## 12 - Pendulum Support





- ☐ First install pendulum support to the transmission and then to the subframe

### 13 - Bolt

- ☐ 100 Nm + 90°
- ☐ Always replace
- ☐ Pendulum support to subframe

### 14 - Bolt

- ☐ 60 Nm + 90°
- ☐ Always replace
- ☐ Transmission mount to transmission support

### 15 - Bolt

- ☐ 40 Nm + 90°
- ☐ Always replace
- ☐ Transmission mount to body

### 16 - Transmission Mount

- ☐ The illustration shows the DSG® transmission version

### 17 - Bolt

Tightening specification:

- ☐ Vehicles with a manual transmission. Refer to ⇒ Manual Transmission; Rep. Gr. 34; Description and Operation.
- ☐ Vehicles with a DSG transmission. Refer to ⇒ Direct Shift Gearbox; Rep. Gr. 34; Description and Operation.
- ☐ Transmission support to transmission

### 18 - Transmission Support

## 1.2 Subframe Mount, Adjusting

### Special tools and workshop equipment required

- ◆ Engine Support Bridge -10-222A-
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10- (quantity: 2)
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12- (quantity: 2)
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13- (quantity: 2)
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-

### Procedure



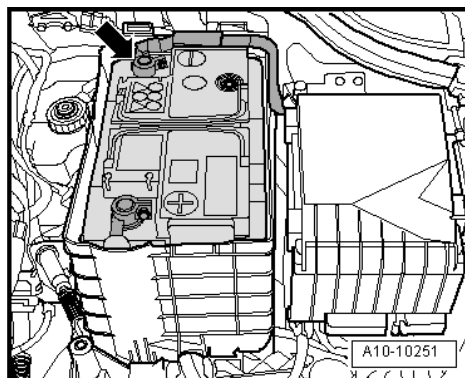
#### Note

*If only the subframe mount on the engine side needs to be adjusted, a Engine Support - Bracket w/Spindle and hook -10-222A/10- will be sufficient. It is not necessary to remove the air filter, battery and battery tray.*

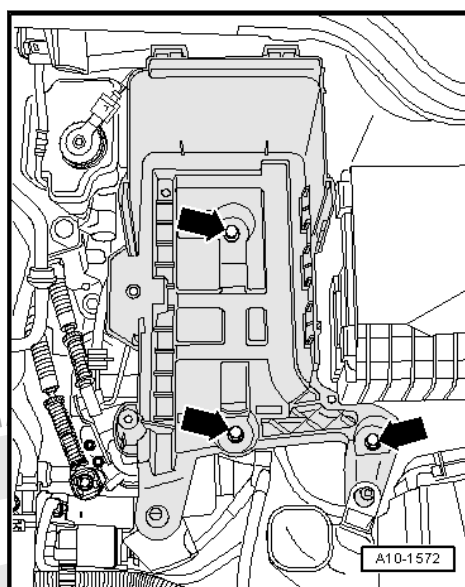
- Remove the engine cover. Refer to ⇒ [C3.1 over](#)”, [page 17](#) .
- Remove the air filter. Refer to ⇒ [F4.2 ilter Housing](#)”, [page 404](#) .



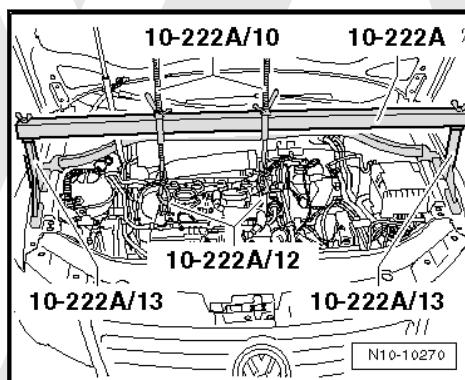
- Switch off the ignition and disconnect the battery Ground (GND) cable -arrow-. Refer to ➔ Electrical Equipment; Rep. Gr. 27; Battery; Battery, Disconnecting and Connecting.



- Remove the battery and battery tray -arrows-.



- If equipped, remove the charge air guide to the sound generator.
- Mount the Engine Support Bridge -10-222A- with the following tools:

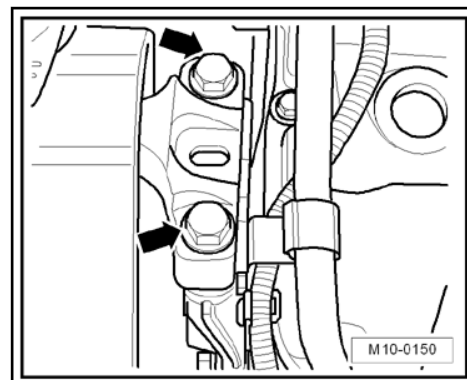


- ♦ Engine Support - Bracket w/Spindle and hook -10-222A/10- (quantity: 2)
- ♦ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12- (quantity: 2)

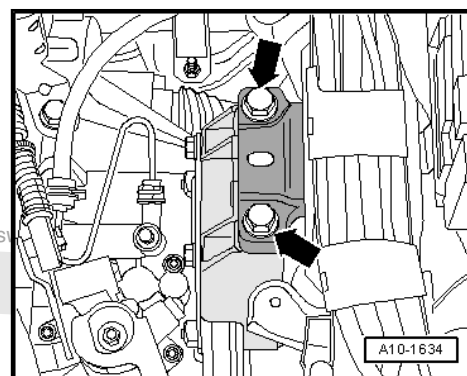




- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13- (quantity: 2)
- Secure the Engine/Gearbox Support Shackle (2 pc.) -10-222A/12- to both mounts on the front of the engine and engage the Engine Support - Bracket w/Spindle and hook -10-222A/10-.
- Support the engine with the transmission but do not lift it.
- Replace the subframe mount bolts -arrows- one after the other (if it was not already performed with the engine installed) and hand tighten.

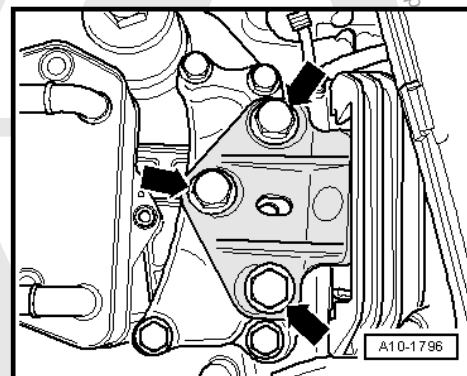


#### Vehicles with Manual Transmission



- Replace the subframe mount bolts -arrows- one after the other (if the was not already performed with the engine was installed) and hand tighten.

#### Vehicles with DSG® Transmission

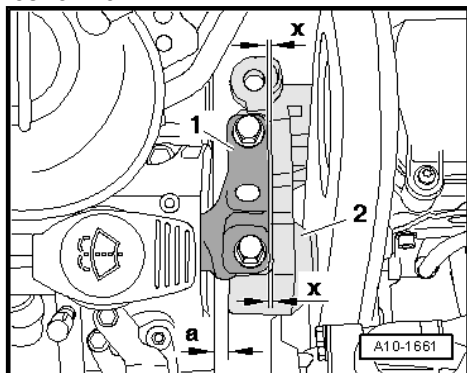


- Replace the subframe mount bolts -arrows- one after the other (if the was not already performed with the engine was installed) and hand tighten.



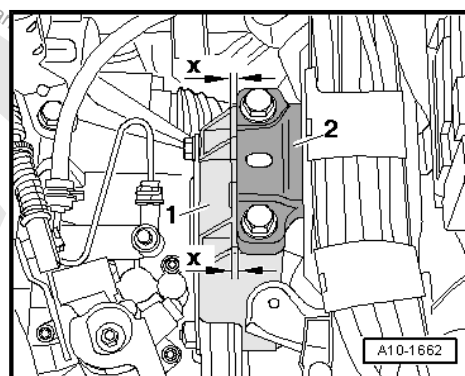
### Continuation for All Vehicles

- Loosen left and right support arm bolts approximately two turns.
- Between engine support and right longitudinal member, there must be clearance -a- 10 mm.



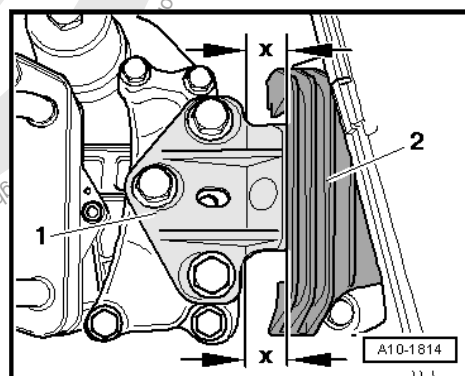
- The casting edge on the engine support -2- must be parallel to the support arm -1-; dimension -x- must be the same at the front and at the rear.

### Vehicles with Manual Transmission



- Make sure that the edges on the support arm -1- and transmission mount -2- are parallel on the transmission side.
- Dimension -x- same size on both sides of bracket.

### Vehicles with DSG® Transmission



- Make sure that the edges on the support arm -1- and transmission mount -2- are parallel on the transmission side.
- Dimension -x- same size on both sides of bracket.



### Continuation for All Vehicles

- Tighten subframe mount bolts. Subframe mount tightening specifications. Refer to [⇒ -1.1 Subframe Mount", page 9](#).

Installation is performed in reverse order of the removal.



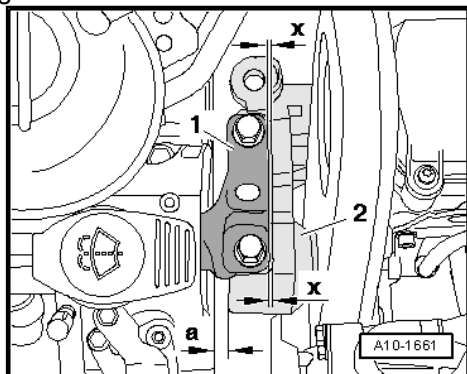


## 2 Diagnosis and Testing

⇒ [M2.1 ount, Checking Adjustment", page 16](#)

### 2.1 Subframe Mount, Checking Adjustment

- There must be at least 10 to 13 mm -a- between engine support and right longitudinal member.



- The casting edge on the engine support -2- must be parallel to the support arm -1-; dimension -x- must be the same at the front and at the rear.



#### Note

*Distance -a- can also be checked with corresponding round stock.*

Only if there is noise (the engine or transmission hitting the longitudinal member when driving around curves) and dimension -a- is not within 10 to 13 mm:

- Adjust the subframe mount. Refer to ⇒ [M1.2 ount, Adjusting", page 11](#) .



### 3 Removal and Installation

⇒ C3.1 over", page 17

⇒ R3.2 emoving", page 18

⇒ a3.3 nd Transmission, Separating", page 29

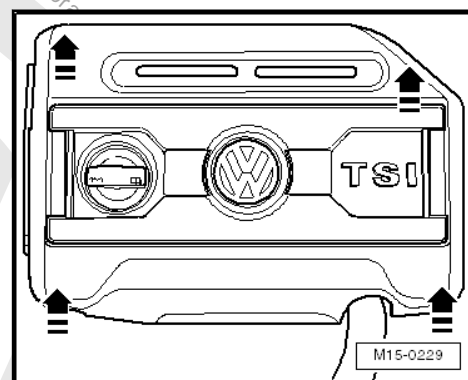
⇒ S3.4 ecuring on Engine and Transmission Holder", page 30

⇒ I3.5 nstalling", page 31

#### 3.1 Engine Cover

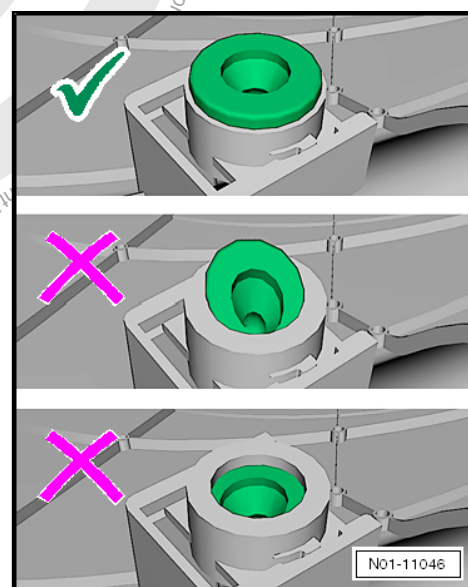
##### Removing

- Remove the engine cover in direction of -arrows-.



##### Installing

- Make sure the rubber buffers fit correctly into the mounts when installing.



- Carefully press the engine cover back into the catch.



##### Note

*In order to prevent causing damage, do not hit the engine cover with your fist or a tool.*



## 3.2 Engine, Removing

### Special tools and workshop equipment required

- ◆ Tensioning Strap -T10038-
- ◆ Locking Pin -T10060A-
- ◆ Engine/Gearbox Jack - Engine Support -T10359-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Engine and Gearbox Jack -VAS6931-
- ◆ Step Ladder -VAS5085-
- ◆ Engine Bung Set -VAS6122-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Spring Clip Pliers
- ◆ Cable Tie



### Note

- ◆ *To perform work sequence, the battery Ground (GND) cable must be disconnected. For this reason check if a coded radio is installed. If necessary, obtain anti-theft coding beforehand.*
- ◆ *The engine is removed downward together with the transmission.*
- ◆ *All cable ties which are opened or cut open when removing engine, must be replaced in the same position when installing engine.*
- ◆ *Seal off removed fuel, ventilation and vacuum lines so no dirt enters the system.*
- ◆ *Leave the key in the ignition lock to prevent the steering lock from engaging.*



### Caution

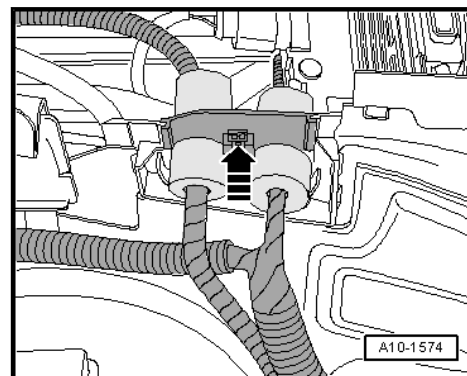
**When doing any assembly work, especially in the engine compartment, pay attention to the following due to the limited space.**

- ◆ **Route lines of all types (for example for fuel, hydraulic, Evaporative Emission (EVAP) canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.**
- ◆ **To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.**

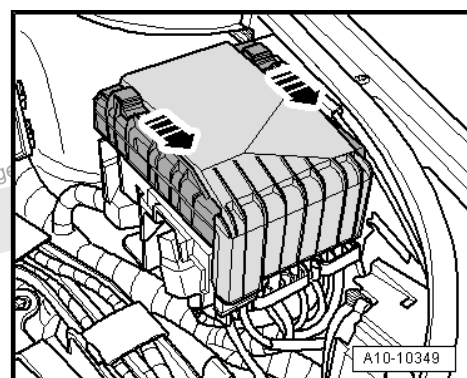
- Check the Diagnostic Trouble Code (DTC) memory for all control modules before removal Vehicle Diagnostic Tester "On Board Diagnostics (OBD)".
- Remove the engine cover. Refer to [⇒ C3.1 over](#), page 17 .
- Remove the air filter. Refer to [⇒ F4.2 ilter Housing](#)", page 404 .



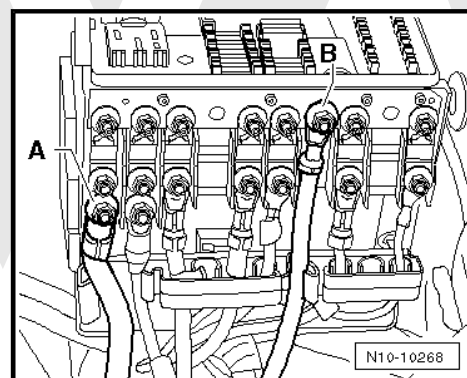
- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27; Removal and Installation.
- If equipped, remove the charge air guide to the sound generator.
- Disconnect the engine wiring harness connector on the Engine Control Module. Refer to ⇒ [E4.3 Engine Control Module J623, Removing and Installing](#), page 406 .
- Release pass-through for engine wiring harness in direction of -arrow- and pull off upward.



- Remove the E-box cover from the engine compartment by sliding both latches in direction of -arrows-.

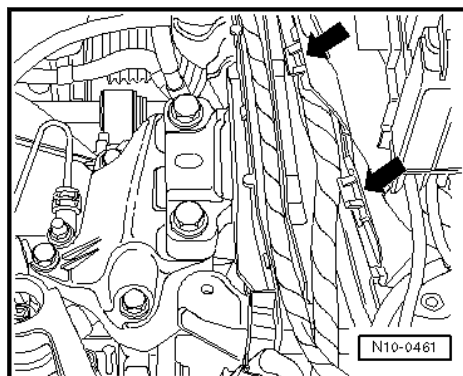


- Disconnect the wire from the Generator -A- and the wire from the battery -B- on the fuse holder.

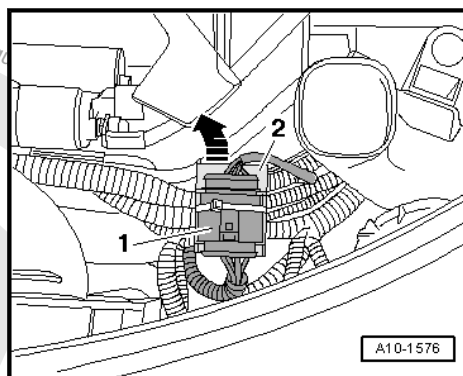


- Open all the cable guide locking mechanisms on the longitudinal member -arrows-.





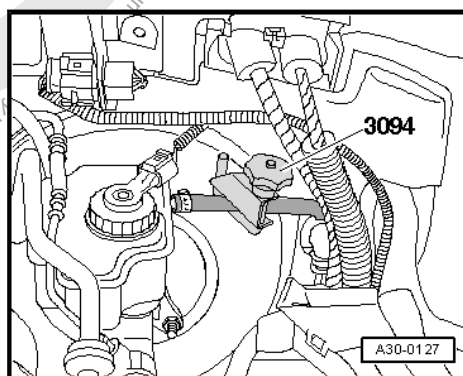
- Free up the connector -1- and disconnect.



- Open the underlying wiring guide bracket -2-.
- Take the Engine Control Module wiring harness out of the wiring router and lay it on the engine.

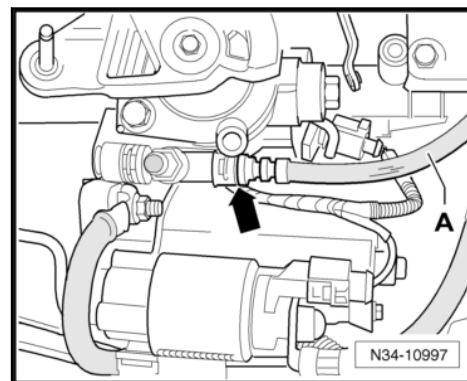
#### Vehicles with Manual Transmission

- Remove the selector mechanism from the transmission: Refer to ➤ Manual Transmission; Rep. Gr. 34; Removal and Installation.
- Clamp off the return hose leading to the master cylinder using the Hose Clamps - Up To 25mm -3094-.



- Pull the clamp -arrow- for the line -A- up to the stop.





- Pull the line -A- out of the ventilator/slave cylinder and seal it off.



#### Caution

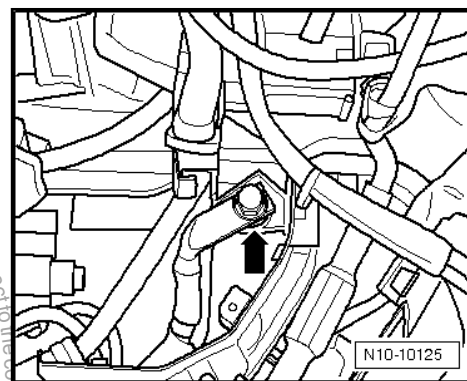
*Do not operate clutch pedal any more.*

#### Vehicles with DSG® Transmission

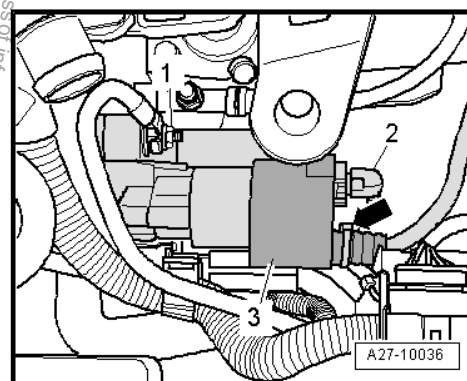
- Remove the selector lever cable from the transmission. Refer to ➔ Direct Shift Gearbox; Rep. Gr. 34; Removal and Installation.

#### Continuation for All Vehicles

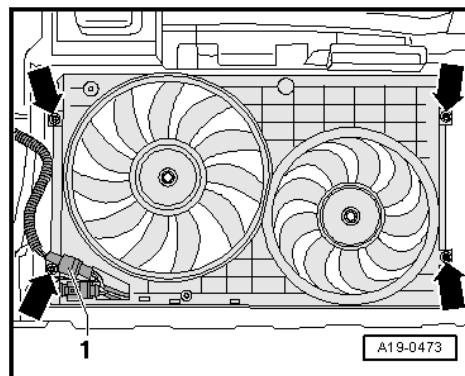
- Disconnect the Ground (GND) wire on the longitudinal member -arrow-.



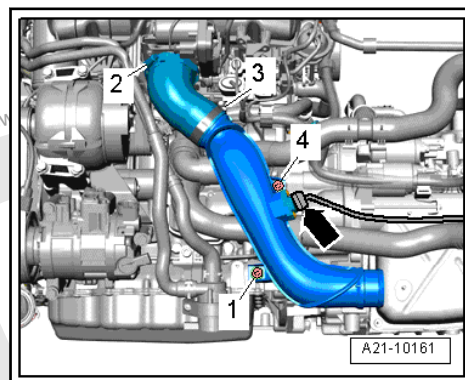
- Disconnect the connector -2-.



- Remove the upper mounting bolts for the air shroud -arrows-.



- Loosen the hose clamp -2-.



- Remove the bolt -4-.
- Disconnect the connectors -arrow- and free up the electric wire.



#### WARNING

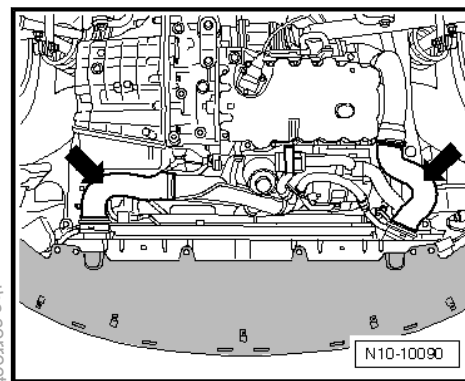
***Risk of scalding due to hot steam and hot coolant:***

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective eyewear and protective clothing to prevent eye injury and scalding.***
- ◆ ***Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.***

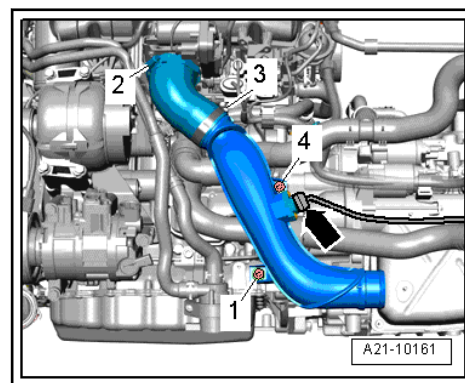
- Open cap on coolant expansion tank.
- Remove the front wheels.
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the front section of the wheel housing liners or remove the front wheel housing liners. Refer to ⇒ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Remove the charge air hoses -arrows-.



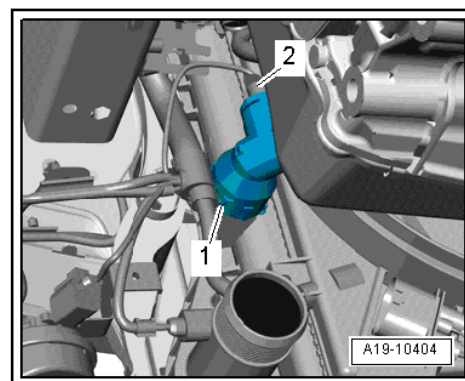
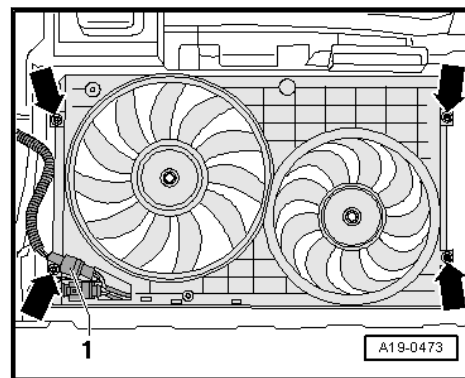
- Remove the bolt -1- and remove the air guide pipe downward.



- Disconnect the connector -1- and remove the lower mounting bolts -arrows- for the air shroud.



- Remove the air shroud downward.
- Disconnect the connector -2- for the Engine Coolant Temperature Sensor on Radiator Outlet -G83-.

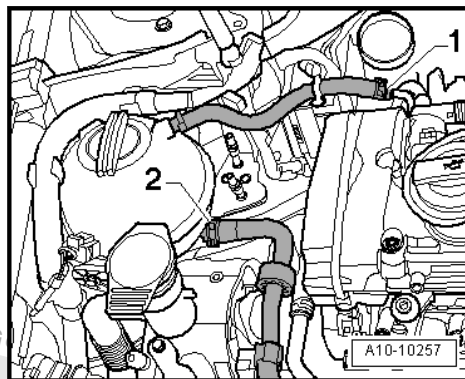




## Note

*Collect escaping coolant in a clean container for disposal or reuse.*

- Place a Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208- under the engine.
- Drain the coolant. Refer to ➔ [D1.1 raining and Filling](#)”, page 229 .
- Remove coolant hoses -1 and 2-.

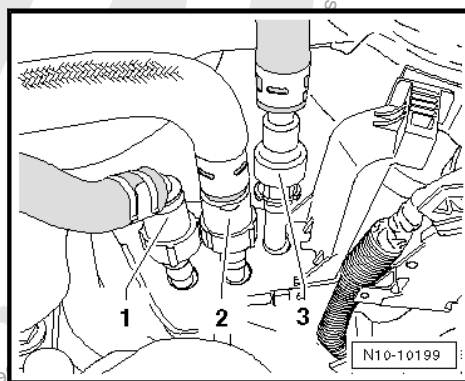


## WARNING

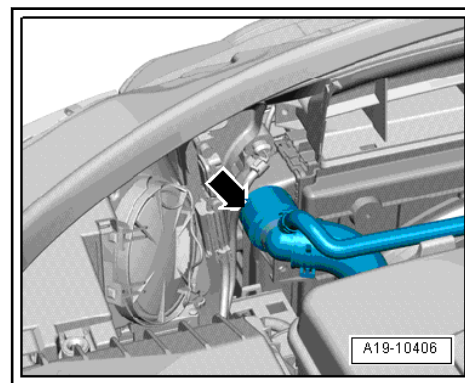
***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

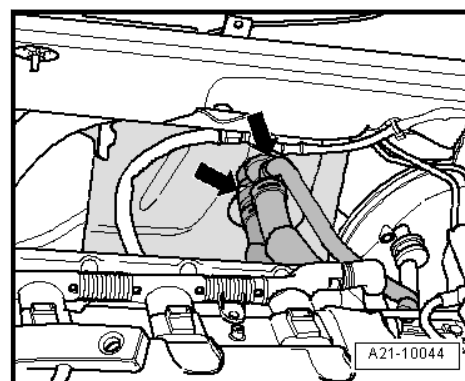
- Disconnect the lines on the connection and catch any fuel coming out with a cloth.



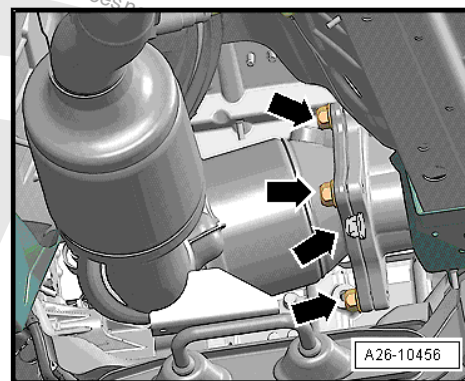
- 1 - Ventilation line (press the circlip to release the line).
- 2 - Vacuum line (press the circlip to release the line), if equipped.
- 3 - Fuel supply line (pull the circlip upward to release the line).
- Remove upper coolant hose -arrow- from radiator by removing securing clip.



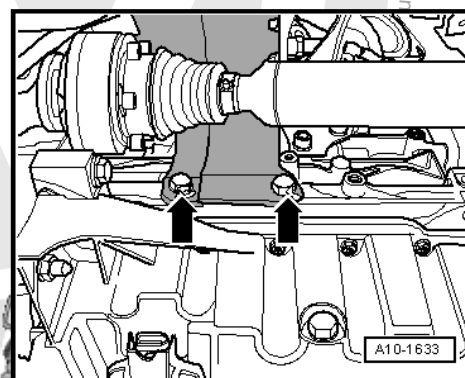
- Disconnect the heat exchanger coolant hoses -arrows-.



- From the top, remove the nuts -arrows- on the connection of the front exhaust pipe connection to the turbocharger.



- Remove the right drive axle heat shield -arrows-.



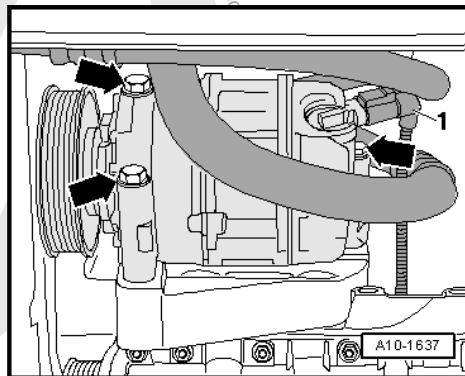
- Remove the drive axles. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40; Removal and Installation.



- Remove the front exhaust pipe with catalytic converter. Refer to ➤ [E3.2 xhaust Pipe](#), page 444 .

#### Vehicles with Air Conditioning (A/C) System

- Remove the ribbed belt. Refer to ➤ [B5.3 elt](#), page 60 .
- Disconnect solenoid clutch electrical connector -1- on A/C compressor.



#### WARNING

**Risk of injury from refrigerant:**

- ◆ **Do not open the A/C system refrigerant circuit.**

- Remove the A/C compressor bolts -arrows-.



#### Caution

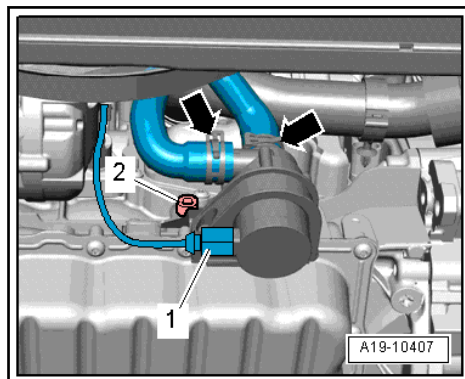
**There is a risk of damaging the refrigerant lines and hoses.**

- ◆ **Do not bend, twist or stretch the refrigerant lines and hoses.**

- Tie up the A/C compressor to the longitudinal member with the refrigerant hoses still connected.

#### Continuation for All Vehicles

- Remove the Generator -C-. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Removal and Installation.
- Remove the bolt -2- on the bracket for the After-Run Coolant Pump -V51-.



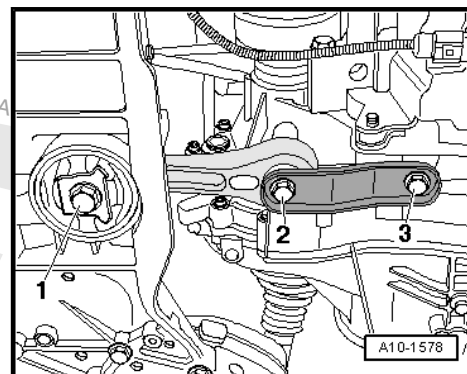




# **Note**

*The After-Run Coolant Pump -V51- stays in the installed position.*

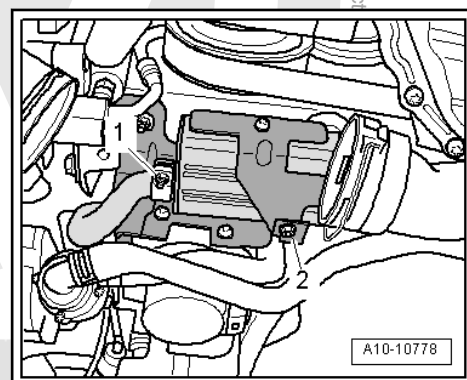
- First unscrew bolt -1-.



- Remove the bolts -2 and 3- and remove the pendulum support.

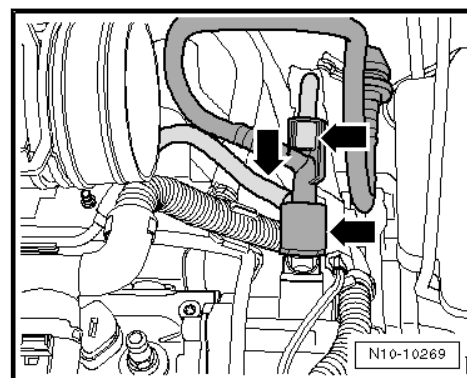
## **Vehicles with Parking Heater**

- Loosen the clamp -1- and remove the bolt -2-.



- Remove the parking heater muffler.
- Disconnect the connections on the coolant pipes.

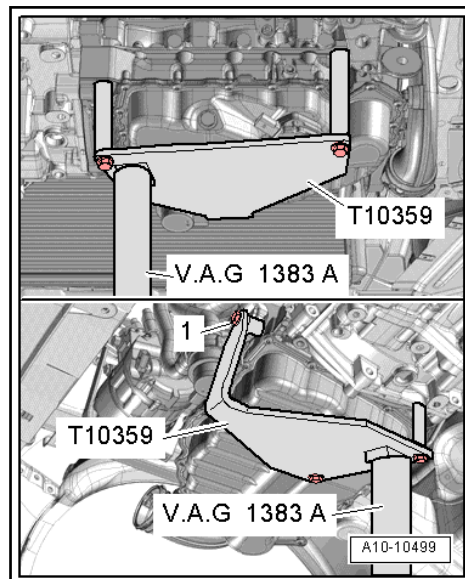
## **Continuation for All Vehicles**



- Disconnect the vacuum hoses -arrows-.
- Remove/disconnect all wires necessary from engine/transmission and set aside.



- Disconnect all connections, coolant, vacuum and intake hoses from the engine.
- Tighten the Engine/Gearbox Jack - Engine Support - T10359- to the cylinder block using the bolt -1- to approximately 20 Nm.



#### Note

*The threaded hole for the bolt -1- serves to secure the After-Run Coolant Pump -V51-.*

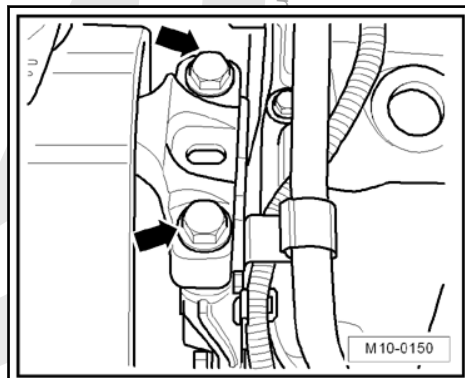
- Install the Engine and Gearbox Jack -VAS6931- on the Engine/Gearbox Jack - Engine Support -T10359A-.
- Slightly lift the engine/transmission subassembly.



#### Note

*Use the Step Ladder -VAS5085- to remove the subframe mount bolts.*

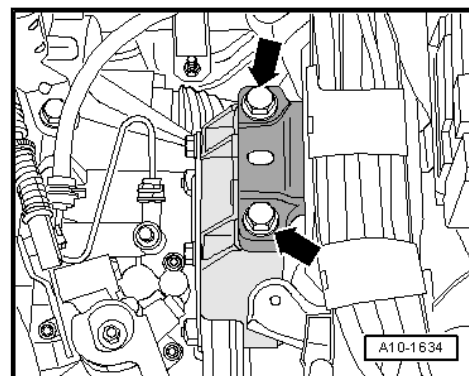
- Remove the subframe bolts -arrows- on the engine.





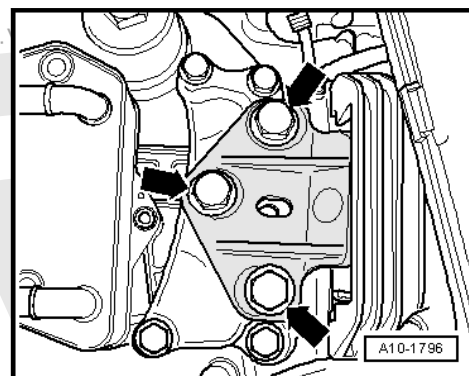


## Vehicles with Manual Transmission



- Remove the subframe bolts -arrows- on the transmission.

## Vehicles with DSG® Transmission



- Remove the subframe bolts -arrows- on the transmission.

## Continuation for All Vehicles



### Note

- ◆ *Verify that all hose and line connections between engine, transmission and body have been disconnected.*
- ◆ *While lowering, carefully guide engine/transmission assembly in order to prevent damages.*

## Vehicles with DSG® Transmission

- Pay attention to the selector lever cable.

## Continuation for All Vehicles

- Pull the engine/transmission as far as possible to the front and left and slowly lower it.

Secure the engine on the Engine and Gearbox Bracket - VAS6095A- when performing repair work. Refer to [⇒ S3.4 ecur-ing on Engine and Transmission Holder](#), page 30 .

## 3.3 Engine and Transmission, Separating

### Special tools and workshop equipment required

- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Shop Crane -VAS6100-
- ◆ Engine/Gearbox Jack - Engine Support -T10359-



### Conditions

- Engine with the transmission is removed and secured to the Engine/Gearbox Jack - Engine Support -T10359A-.

### Disconnecting

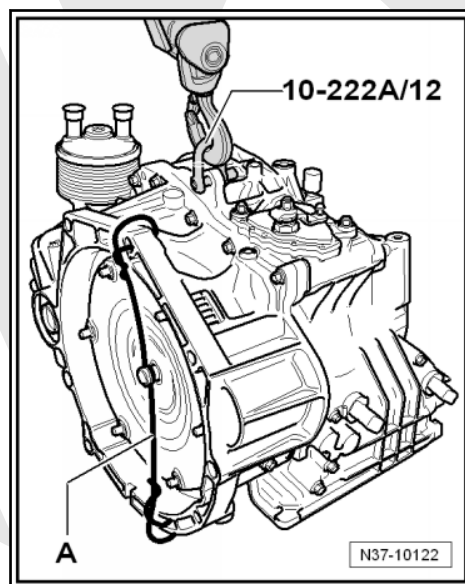
- Remove the starter. Refer to ⇒ Electrical Equipment; Rep. Gr. 27; Removal and Installation.

### Engine with DSG® Transmission

- Remove the coolant hoses from the transmission oil cooler and seal off the openings.

### Continuation for All Transmissions

- Disconnect all the electrical connections from the transmission to the engine and free them up.
- Secure the transmission with Engine/Gearbox Support Shackle (2 pc.) -10-222A/12- on the Shop Crane -VAS6100- but do not lift.
- Remove the upper engine/transmission connecting bolts.
- Before removing the last connecting bolts, support the transmission with the Workshop Crane.
- Remove the lower engine/transmission connecting bolts.
- Separate the transmission from the engine; when doing this, guide the transmission.



### Assembling

Assemble in reverse order of removal and note the tightening specification:

- ◆ ⇒ Manual Transmission; Rep. Gr. 34; Description and Operation.
- ◆ ⇒ Direct Shift Gearbox; Rep. Gr. 34; Description and Operation.

## 3.4 Engine, Securing on Engine and Transmission Holder

### Special tools and workshop equipment required

- ◆ Engine Sling -2024A-



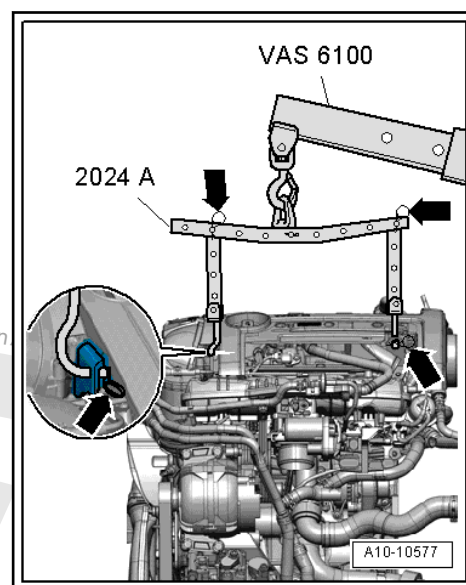
- ◆ Shop Crane -VAS6100-
- ◆ Engine and Gearbox Bracket VAS6095A -VAS6095A-

#### Conditions

- The engine and transmission are removed and secured with the Engine/Gearbox Jack - Engine Support -T10359A- on the Engine and Gearbox Jack -VAS6931-.

#### Procedure

- Separate the transmission from the engine. Refer to [a3.3 nd Transmission, Separating", page 29](#) .
- Engage the Engine Sling -2024A- as shown and use the Shop Crane -VAS6100- to lift it out of the Engine and Gearbox Jack -VAS6931-.



#### Caution

***Use securing pins -arrows- on the hooks and pins to prevent damaging the engine.***

- Secure the engine on the Engine and Gearbox Bracket -VAS6095A-.

### 3.5 Engine, Installing

Subframe mount. Refer to [a5.1.1 Subframe Mount", page 9](#) .

Install in reverse order of removal. Note the following:

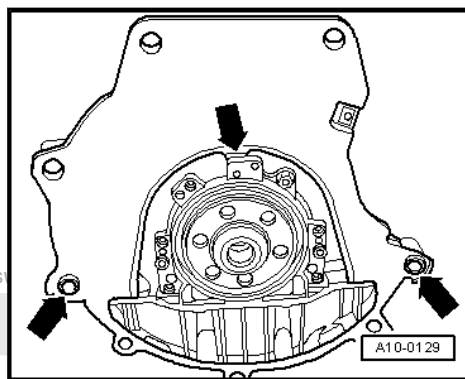


### Caution

*When doing any assembly work, especially in the engine compartment, pay attention to the following due to the limited space.*

- ◆ *Route lines of all types (for example for fuel, hydraulic, Evaporative Emission (EVAP) canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.*

- Insert new alignment sleeves for centering engine/transmission in cylinder block.
- Engage the intermediate plate with the sealing flange and then slide it onto the alignment sleeves -arrows-.



### Vehicles with Manual Transmission

- Assembly work done to the clutch. Refer to ➤ Manual Transmission; Rep. Gr. 30; Description and Operation.

### Vehicles with DSG® Transmission

- Assembly work done to the clutch. Refer to ➤ Direct Shift Gearbox; Rep. Gr. 30; Description and Operation.
- Replace the needle bearings in the crankshaft. Refer to ➤ [N5.1 Needle Bearing, Replacing](#), page 57.
- Pay attention to the selector lever cable.

### Continuation for All Vehicles

- When installing engine/transmission assembly, check for clearance to subframe as well as to radiator.
- Adjust the subframe mount. Refer to ➤ [M1.2 Mount, Adjusting](#), page 11.



### Note

*Subframe mount tightening specifications. Refer to ➤ [-1.1 Subframe Mount](#), page 9, Overview - Subframe Mount.*

### Vehicles with Manual Transmission

- Install the selector mechanism on the transmission. Refer to ➤ Manual Transmission; Rep. Gr. 34; Removal and Installation.



## Vehicles with DSG® Transmission

- Install the selector lever cable on the transmission. Refer to ➤ Direct Shift Gearbox; Rep. Gr. 34; Removal and Installation.

## Continuation for All Vehicles

Electrical connections and wiring routing. Refer to ➤ Electrical Equipment; Rep. Gr. 97.

- Observe the notes after connecting the Battery. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Removal and Installation.
- Fill with coolant. Refer to ➤ **D1.1 raining and Filling**, page 229.
- Check the Diagnostic Trouble Code (DTC) memories of all control modules and erase any DTC entries which may have occurred during the assembly Vehicle Diagnostic Tester "On Board Diagnostics (OBD)".
- Perform a road test.



### Note

*Follow all applicable safety precautions during a road test. Refer to ➤ **page 3**.*

- Then a perform vehicle system test and repair any occurring malfunctions.



### Note

*If the DTC memory was erased, the readiness code must be re-generated using the Vehicle Diagnostic Tester in "Guided Fault Finding" function.*

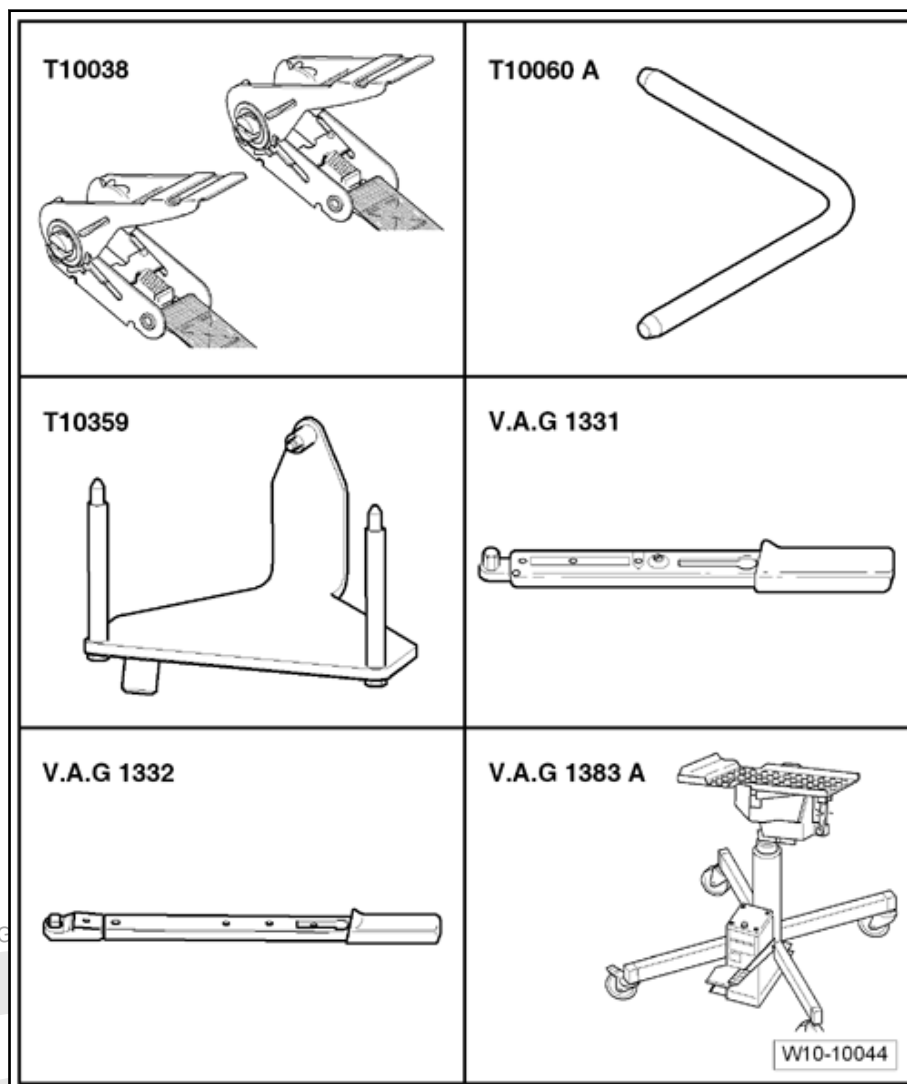
## Tightening Specifications

Bolted Connection		Tightening Specification
Bolts and Nuts	M 6	9 Nm
	M 7	15 Nm
	M 8	23 Nm
	M 10	40 Nm
	M 12	60 Nm

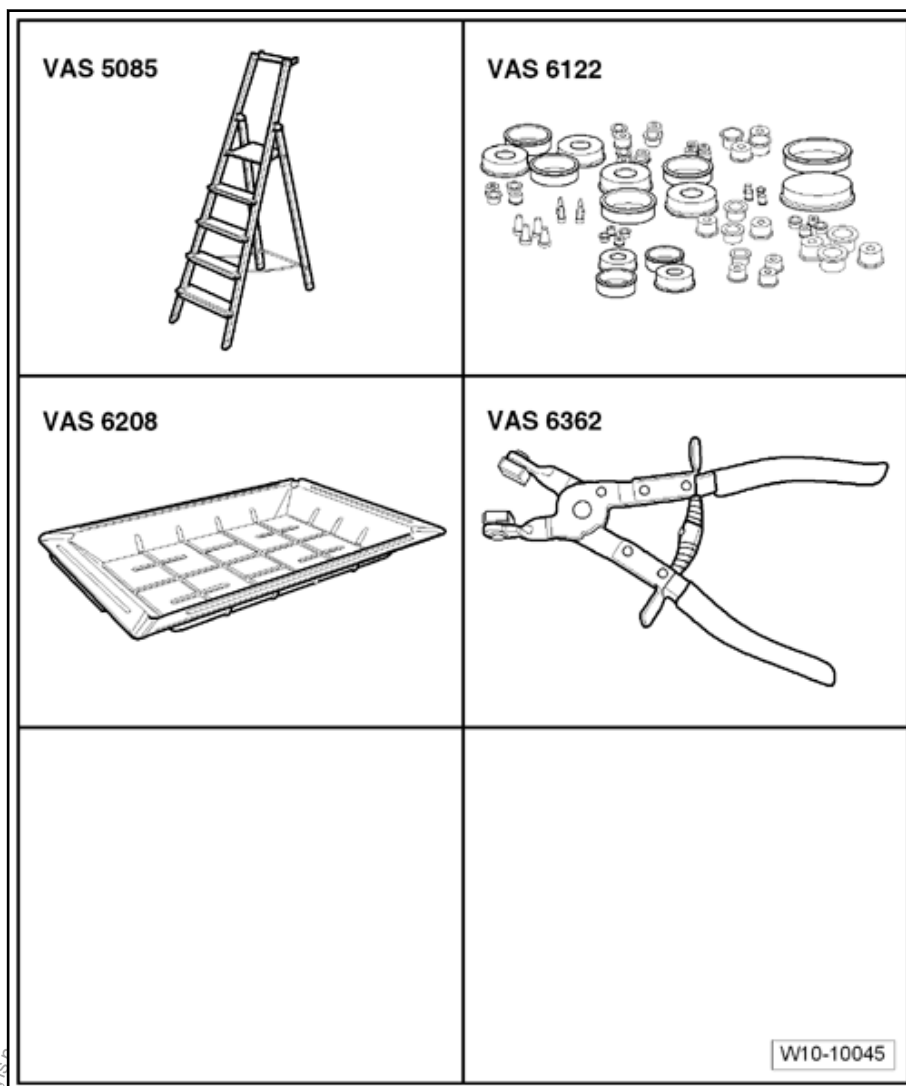


## 4 Special Tools

Special tools and workshop equipment required

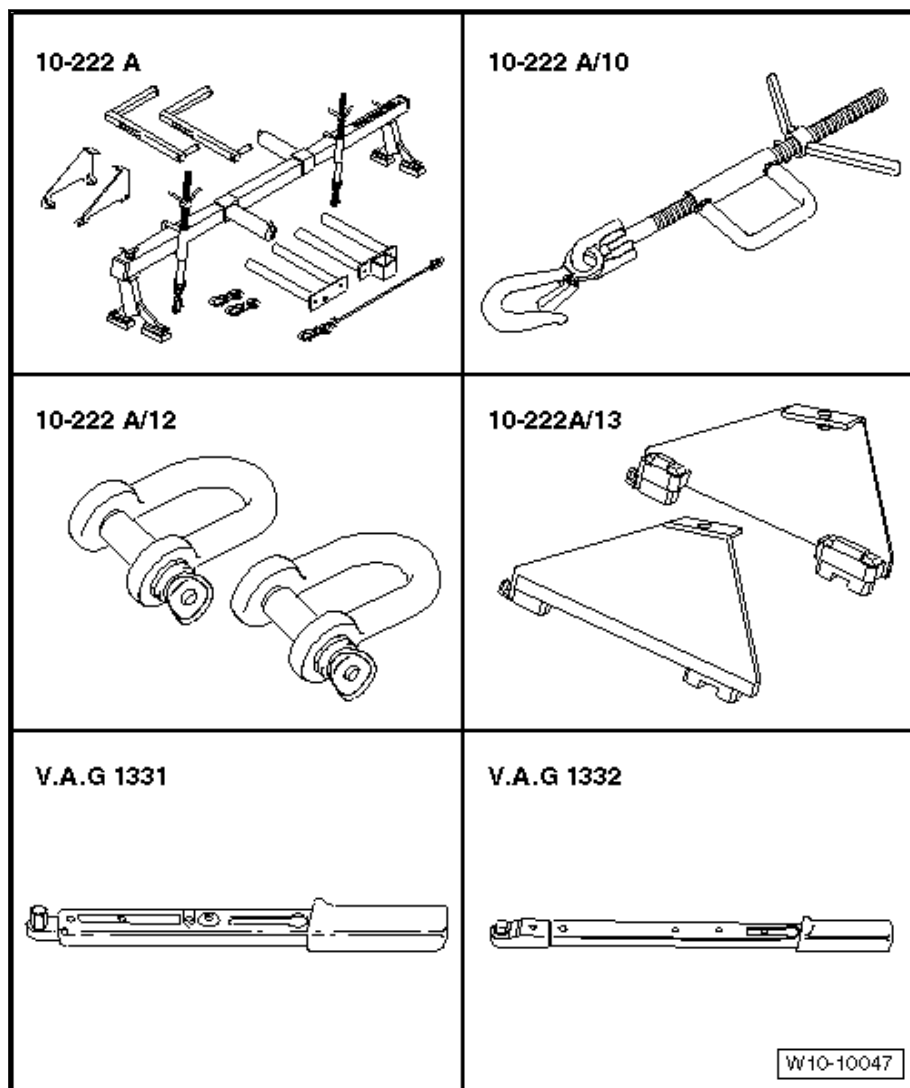


- ◆ Tensioning Strap -T10038-
- ◆ Locking Pin -T10060A-
- ◆ Engine/Gearbox Jack - Engine Support -T10359-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Engine and Gearbox Jack -VAS6931-



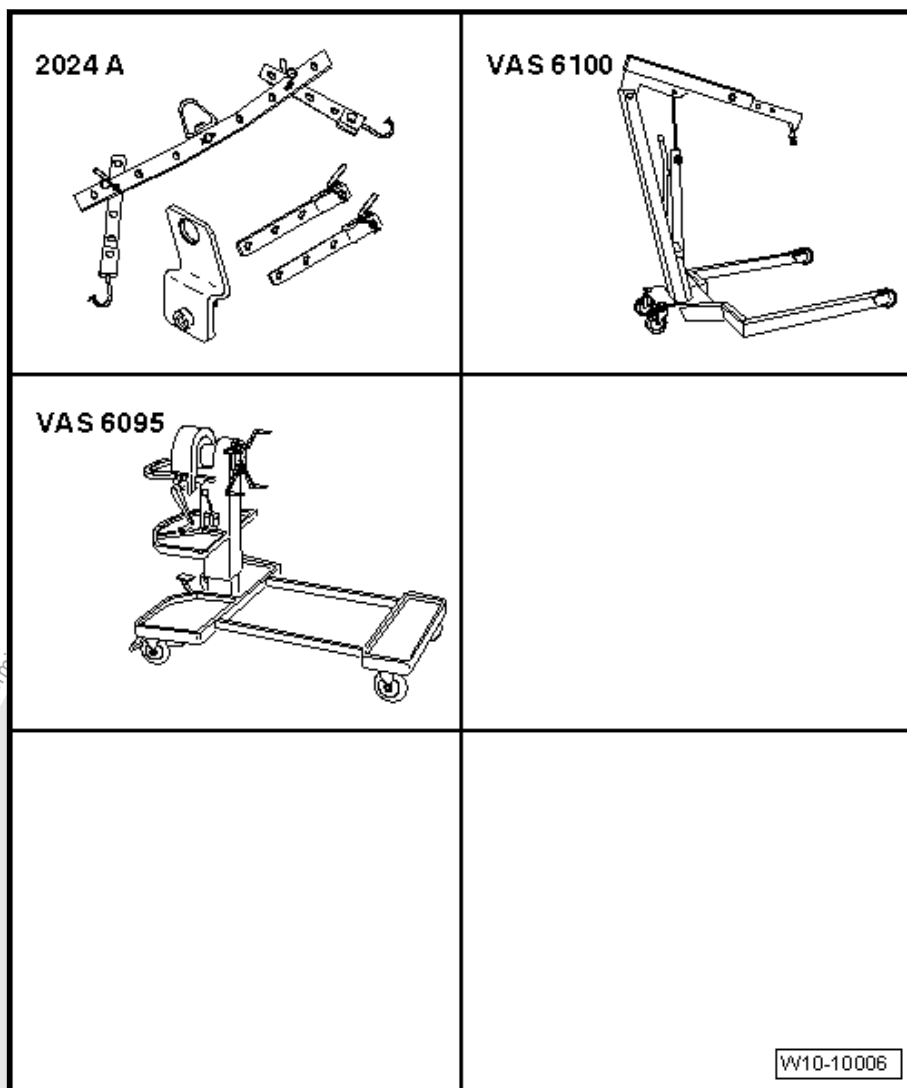
- ◆ Step Ladder -VAS5085-
- ◆ Engine Bung Set -VAS6122-
- ◆ Drip Tray For VAG1202A-VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Spring Clip Pliers
- ◆ Cable Tie (not illustrated)





- ◆ Engine Support Bridge -10-222A-
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-  
(quantity: 2)
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-  
(quantity: 2)
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13-  
(quantity: 2)
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-





- ◆ Engine Sling -2024A-
- ◆ Shop Crane -VAS6100-
- ◆ Engine and Gearbox Bracket VAS6095A -VAS6095A-



## 13 – Crankshaft, Cylinder Block

### 1 General Information

⇒ [B1.1 bearing Shells Allocation", page 38](#)

⇒ [C1.2 onnecting Rod, Separating", page 40](#)

#### 1.1 Main Bearing Shells Allocation

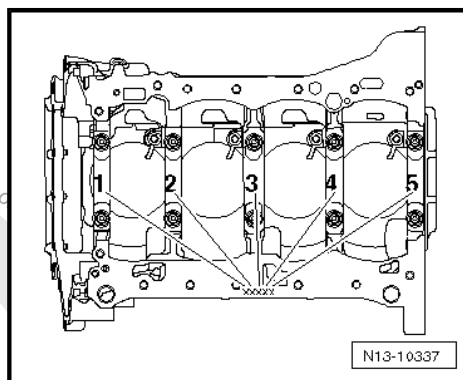
The bearing shells are allocated to the cylinder block with the correct thickness at the factory. Colored dots serve to identify the bearing shell thickness.

The code letters on the lower contact surface or on the top of the cylinder block identify which bearing shell and where it must be mounted on the cylinder block (upper bearing shell).

The code letters on the crankshaft identify which bearing shells and where they must be installed in the bearing cover (lower bearing shell).

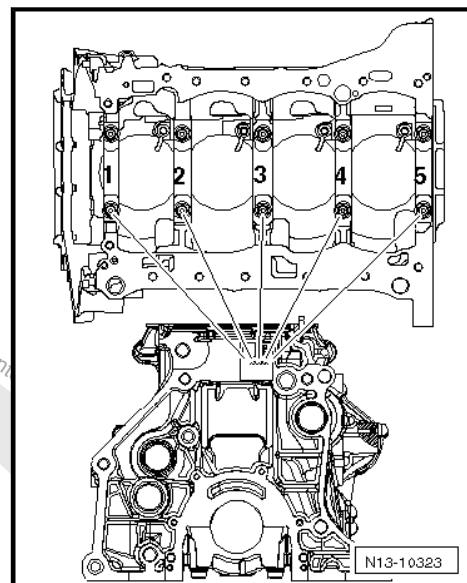
The first letter is for bearing cover one, the second for bearing cover two, etc.

#### Cylinder Block



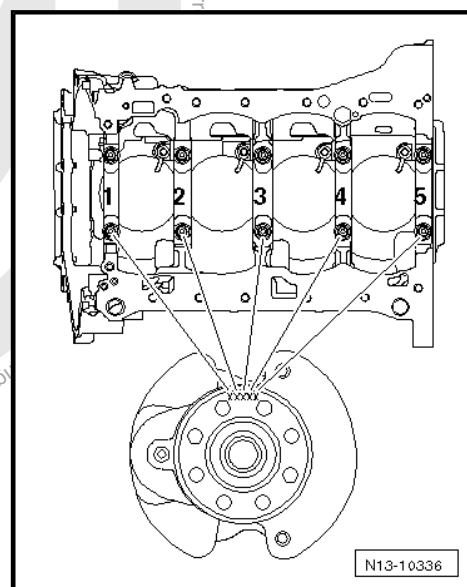
The identification of the cylinder block may be located either on the oil pan sealing surface or on the top (transmission side) of the cylinder block.

The identification on the cylinder block is for the upper bearing shell (cylinder block bearing shell).



- Note the letters and then match them to the color identification in the table. Refer to ➤ [page 39](#) .

#### Crankshaft



The identification on the crankshaft is for the lower bearing shell (bearing cap bearing shell)

- Note the letters and then match them to the color identification in the table. Refer to ➤ [page 39](#) .

#### Color Identification

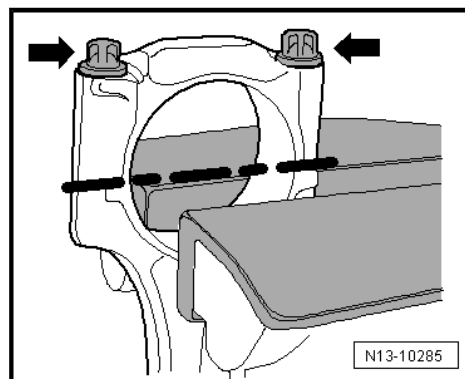
- S = black
- R = red
- G = yellow
- B = blue
- W = white



## 1.2 New Connecting Rod, Separating

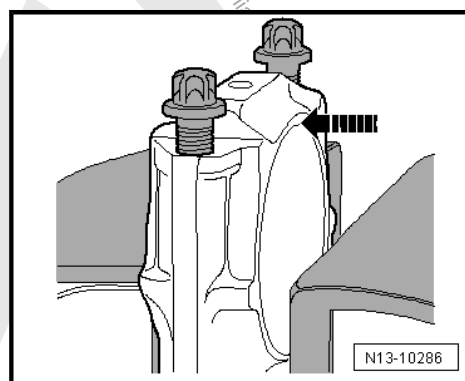
A new connecting rod might not be separated all the way at the predetermined breaking point. If the connecting rod bearing cap cannot be removed by hand, proceed as follows:

- Mark which cylinder belongs to the connecting rod -Item 11- ➔ [Item 11 \(page 47\)](#) .
- Lightly clamp the connecting rod in a vise equipped with aluminum protective pads as shown.



### Note

- ◆ Only clamp the connecting rod lightly to avoid damaging it.
- ◆ Clamp the connecting rod below the dotted line.
- Loosen both bolts -arrows- about 5 turns.
- Carefully tap against the connecting rod bearing cap in direction of -arrow- with a plastic hammer until the cap is loose.





## 2 Description and Operation

⇒ [-2.1 Crankshaft", page 41](#)

⇒ [-2.2 Cylinder Block, Transmission Side", page 43](#)

⇒ [-2.3 Piston and Connecting Rod", page 45](#)

⇒ [-2.4 Ribbed Belt Drive", page 47](#)

### 2.1 Overview - Crankshaft



#### Note

*Secure engine to assembly stand using Engine and Transmission Holder -VAS6095- when performing repair work. Refer to ⇒ [S3.4 securing on Engine and Transmission Holder", page 30](#).*





### 1 - Cylinder Block

- ☐ Checking the cylinder bore. Refer to ➤ [Fig. "Cylinder Bore, Checking", page 54](#).
- ☐ If the cylinder block is being replaced, then the cylinder block bearing shells must be allocated again. Refer to ➤ [B1.1 bearing Shells Allocation", page 38](#).
- ☐ Piston and cylinder dimensions. Refer to ➤ [page 56](#).

### 2 - Cylinder Block Bearing Shell

- ☐ With oil groove
- ☐ Do not interchange used bearing shells (label)
- ☐ Allocation of the crankshaft bearing shells (classification). Refer to ➤ [B1.1 bearing Shells Allocation", page 38](#).

### 3 - Crankshaft

- ☐ After removal, lay aside so that sensor wheel -Item 8- ➤ [Item 8 \(page 43\)](#) is not rested on and becomes damaged
- ☐ If the crankshaft is being replaced, then the bearing shells must be allocated to the bearing cap. Refer to ➤ [B1.1 bearing Shells Allocation", page 38](#).
- ☐ Crankshaft, tightening sequence. Refer to ➤ [Fig. "Crankshaft - Tightening Sequence and Specification", page 43](#)
- ☐ Crankshaft needle bearings, replacing (vehicles with twin clutch transmission). Refer to ➤ [N5.1 Needle Bearing, Replacing", page 57](#)
- ☐ Axial play, checking. Refer to ➤ [M4.1 Measuring Axial Play", page 52](#).
- ☐ Radial play, checking. Refer to ➤ [M4.2 Measuring Radial Clearance", page 52](#)
- ☐ Do not turn crankshaft when measuring radial play.
- ☐ Crankshaft dimensions. Refer to ➤ [D3.1 Dimensions", page 51](#).

### 4 - Bearing Shell

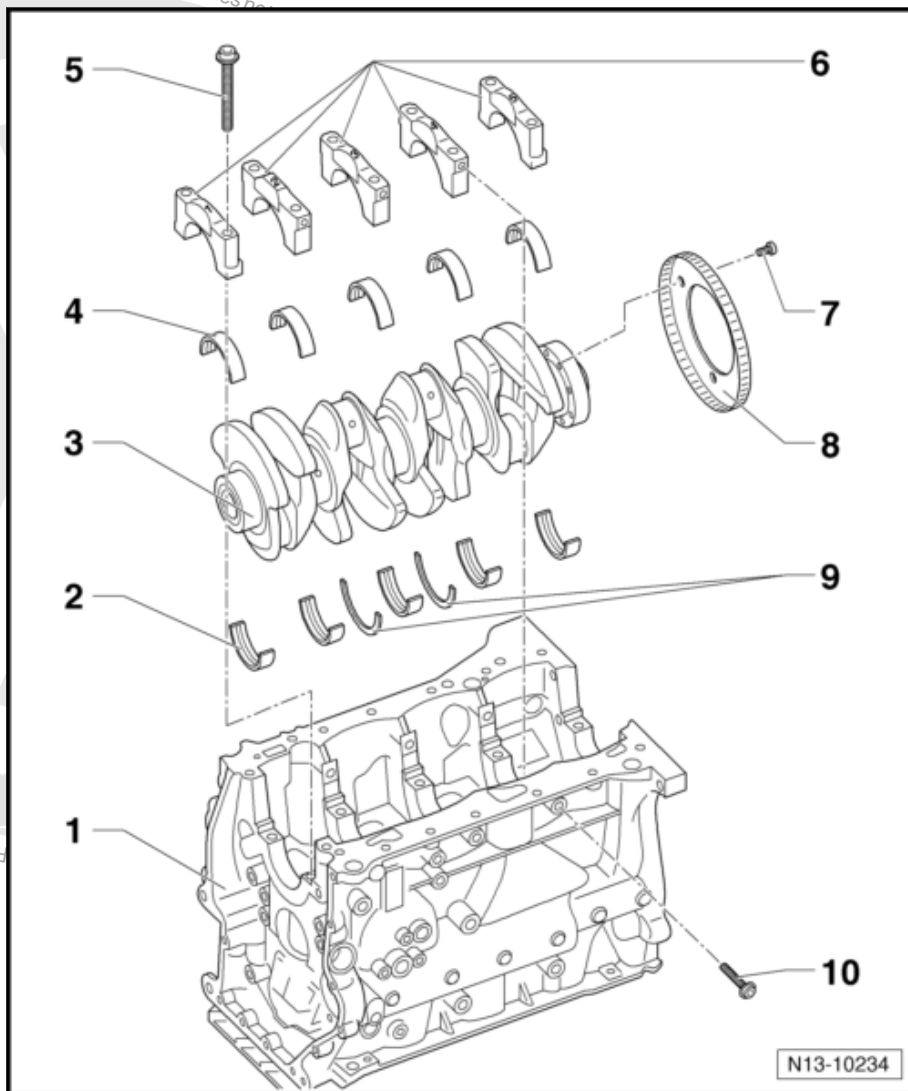
- ☐ Without oil groove
- ☐ Do not interchange used bearing shells (label)
- ☐ Allocation of the crankshaft bearing shells (classification). Refer to ➤ [B1.1 bearing Shells Allocation", page 38](#).

### 5 - Bolt

- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Crankshaft - Tightening Sequence and Specification", page 43](#).
- ☐ Always replace

### 6 - Bearing Cap

- ☐ Bearing cap 1: belt pulley side





- ☐ Retaining tabs of bearing shells and cylinder block/bearing caps must lie above one another

#### 7 - Bolt

- ☐ 10 Nm + 90°

Always replace

- ☐ Replace sensor wheel every time bolts are loosened. Refer to ⇒ [W5.7 heel", page 75](#) .

#### 8 - Sensor Wheel

- ☐ For Engine Speed Sensor -G28-
- ☐ Only possible to install into one position, the holes are offset.
- ☐ Replace sensor wheel every time bolts are loosened. Refer to ⇒ [W5.7 heel", page 75](#) .

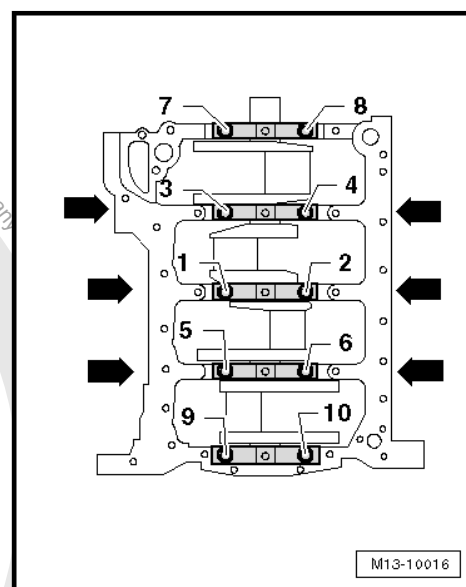
#### 9 - Thrust Washers

- ☐ For bearing 3

#### 10 - Bolt

- ☐ Tightening sequence. Refer to ⇒ [Fig. "Crankshaft - Tightening Sequence and Specification", page 43](#)
- ☐ Always replace

### Crankshaft - Tightening Sequence and Specification



- Tighten the crankshaft bolts in the sequence -1 to 10- as follows.
- 1 - Tighten the bolts -1 through 10- and -arrows- by hand.
- 2 - Tighten the bolts -1 through 10- to 65 Nm.
- 3 - Tighten the bolts -1 through 10- 90° with a wrench.
- 4 - Pre-tighten the bolts -arrows- to 20 Nm.
- 5 - Tighten the bolts -arrows- 90° further using a rigid wrench.

## 2.2 Overview - Cylinder Block, Transmission Side





### 1 - Cylinder Block

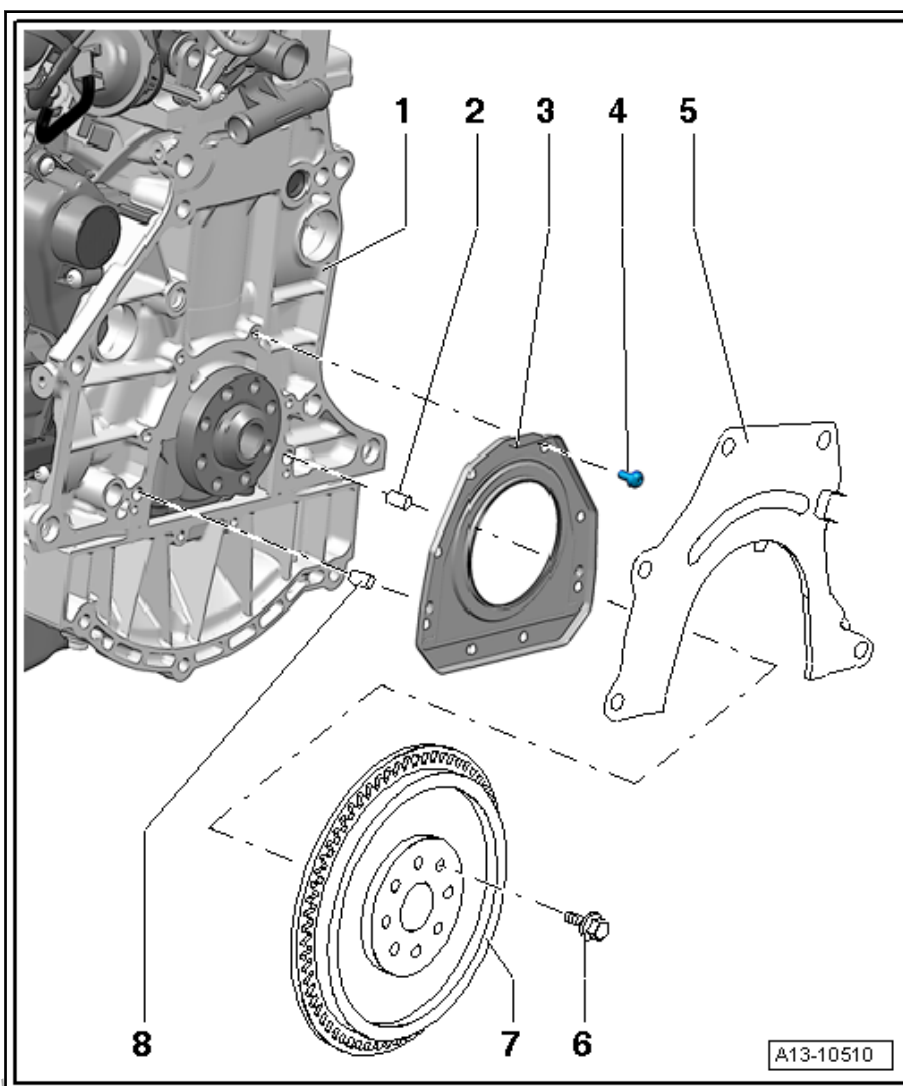
- ☐ Crankshaft, removing and installing. Refer to ➤ [-2.1 Crankshaft](#), page 41.
- ☐ Piston and connecting rod, disassembling and assembling. Refer to ➤ [-2.3 Piston and Connecting Rod](#), page 45.

### 2 - Alignment Pin

- ☐ Not installed

### 3 - Transmission Side Sealing Flange

- ☐ With seal
- ☐ Replace only as a complete unit.
- ☐ Before installing, remove oil remains from crankshaft journal with a clean cloth
- ☐ Do not oil or grease the sealing lip of seal
- ☐ To install, use the guide sleeve that was delivered.
- ☐ Guide sleeve may only be removed after the sealing flange has been slid onto the crankshaft pin.
- ☐ Removing and installing. Refer to ➤ [F5.6 lunge, Removing and Installing, Transmission Side](#), page 67.



### 4 - Bolt

- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Transmission Side Sealing Flange, Tightening Sequence and Tightening Specification"](#), page 45.

### 5 - Intermediate Plate

- ☐ Must be located on alignment sleeves
- ☐ Be careful not to damage or bend when installing
- ☐ Is hooked in at sealing flange. Refer to ➤ [Fig. "Installing Intermediate Plate"](#), page 45

### 6 - Bolt

- ☐ 60 Nm + 90°
- ☐ Always replace
- ☐ For the dual-mass flywheel

### 7 - Dual Mass Flywheel

- ☐ Dual mass flywheel, removing and installing. Refer to ➤ [M5.2 ass Flywheel](#), page 58.
- ☐ Only possible to install into one position, the holes are offset.

### 8 - Alignment Pin

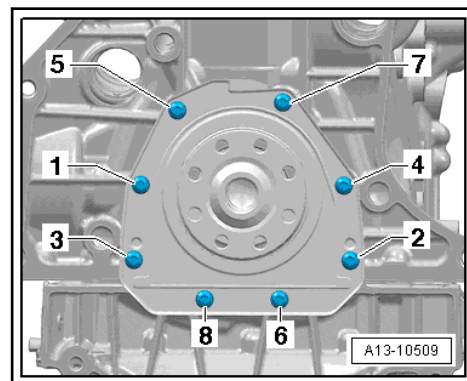
- ☐ Not installed







## Transmission-Side Sealing Flange, Tightening Sequence and Tightening Specification



### Special tools and workshop equipment required

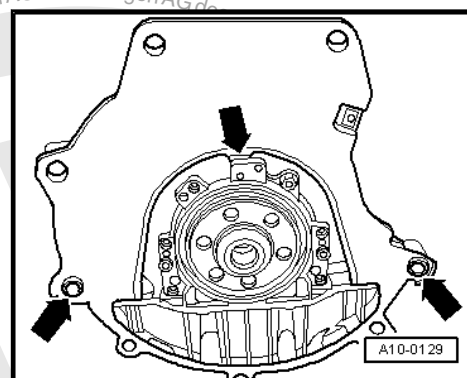
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Procedure

- Tighten bolts in 2 stages in sequence from -1 to 8- as follows:

- 1 - Tighten bolts hand-tight.
- 2 - Tighten the bolts to 9 Nm.

### Installing Intermediate Plate



- Hook in intermediate plate at sealing flange and push it onto the alignment sleeves -arrows-.

## 2.3 Overview - Piston and Connecting Rod



### 1 - Connecting Rod Bolt

- ☐ 45 Nm +90°
- ☐ Always replace
- ☐ Use the old bolt to measure the radial clearance
- ☐ Do not turn an additional 1/4 (90°) for the radial clearance measurement.
- ☐ Lubricate the thread and contact surface.

### 2 - Connecting Rod Bearing Cap

- ☐ Note the installation position
- ☐ Mark the cylinder to which it belongs -A-
- ☐ Installation position: the markings -B- face the belt pulley side
- ☐ Due to the separation procedure (cracking) of the connecting rod, the cap only fits in one position and only to the corresponding connecting rod.
- ☐ New connecting rod separating. Refer to [C1.2 Connecting Rod, Separating](#), page 40.

### 3 - Bearing Shells

- ☐ Note the installation position. Refer to [Fig. "Bearing Shell Installation Position"](#), page 55.
- ☐ Do not interchange used bearing shells (label)
- ☐ New axial play: 0.10 to 0.35 mm
- Wear limit: 0.4 mm
- ☐ Measure the radial clearance with a Plastigauge®.
- New: 0.020 to 0.060 mm
- Wear limit: 0.090 mm
- Do not turn crankshaft when measuring radial play.

### 4 - Relief Valve

27 Nm

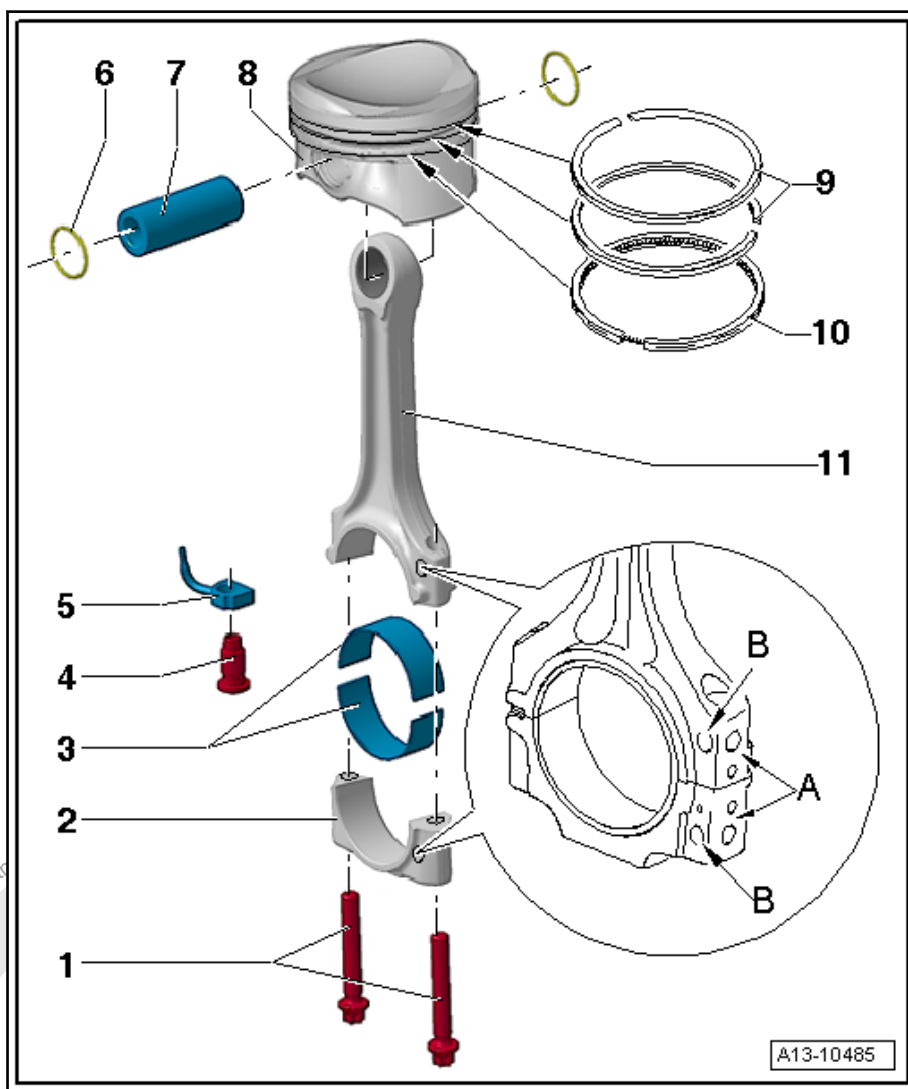
- ☐ Opening pressure: 1.6 to 1.9 bar (23.2 to 27.5 psi)

### 5 - Oil Spray Jet

- ☐ For piston cooling
- ☐ Observe the notes. Refer to [page 195](#).

### 6 - Circlip

### 7 - Piston Pin





- ☐ If difficult to move, warm the piston up to approximately 60 °C (140 °F)
- ☐ Remove and install using the Pilot Drift -VW222A-

#### 8 - Piston

- ☐ Mark installed position and cylinder allocation
- ☐ Arrow on piston face points toward belt pulley side
- ☐ Install with piston ring compressor
- ☐ Checking. Refer to ➤ [Fig. "Pistons, Checking", page 54](#) .
- ☐ Checking the cylinder bore. Refer to ➤ [Fig. "Cylinder Bore, Checking", page 54](#) .
- ☐ Piston and cylinder dimensions. Refer to ➤ [page 56](#) .

#### 9 - Compression Rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers for removing and installing
- ☐ "TOP" mark must face up toward piston crown
- ☐ Checking the ring gap. Refer to ➤ [Fig. "Checking the Piston Ring Gap", page 53](#) .
- ☐ Checking the piston ring groove clearance. Refer to ➤ [Fig. "Piston Ring Groove Clearance, Checking", page 53](#) .

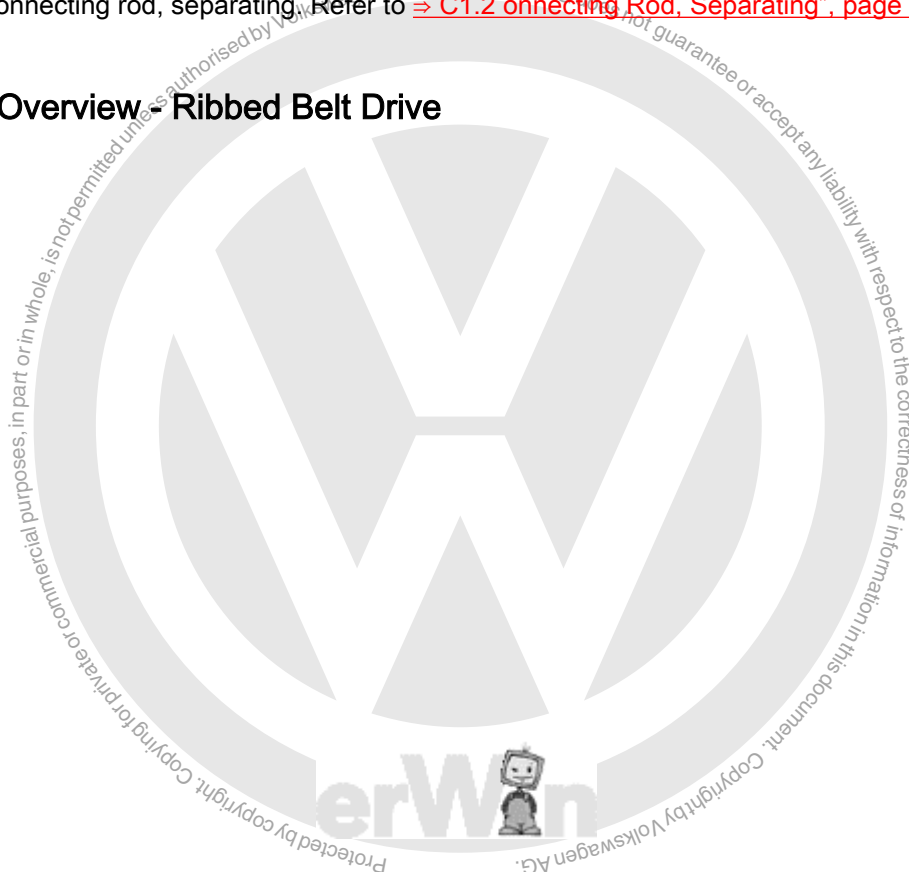
#### 10 - Oil Scraping Ring

- ☐ Two-part
- ☐ Install upper steel ring so gap is offset by 120° to neighboring compression ring
- ☐ Offset all oil scraping ring component gaps to each other
- ☐ Checking the ring gap. Refer to ➤ [Fig. "Checking the Piston Ring Gap", page 53](#) .
- ☐ Height clearance cannot be measured

#### 11 - Connecting Rod

- ☐ Always replace as a set.
- ☐ Mark the cylinder to which it belongs -A-
- ☐ Installation position: the markings -B- face the belt pulley side
- ☐ New connecting rod, separating. Refer to ➤ [C1.2 connecting Rod, Separating", page 40](#) .

## 2.4 Overview - Ribbed Belt Drive





#### 1 - Vibration Damper

- ☐ With ribbed belt pulley
- ☐ Removing and installing. Refer to ➤ [D5.9 amper, Removing and Installing](#), page 78.

#### 2 - O-Ring

- ☐ No replacement part, part of the bolt

#### 3 - Bolt

- ☐ 150 Nm + 90°
- ☐ Always replace
- ☐ Use the Counterhold - Vibration Damper - T10355- to loosen and tighten

#### 4 - Ribbed Belt

- ☐ Check for wear
- ☐ Do not kink



Caution

*Risk of damaging due to reversed running direction on a used ribbed belt:  
Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.*

- ☐ Removing and installing. Refer to ➤ [B5.3 elt", page 60](#).

- ☐ When installing, make sure it is seated correctly on the belt pulleys

#### 5 - Ribbed Belt Tensioner

- ☐ To release tension on the ribbed belt, pivot with a wrench.
- ☐ Secure using the Locking Pin -T10060A-
- ☐ Tensioning device for ribbed belt. Refer to ➤ [Fig. "Ribbed Belt Tensioner Individual Components"](#), page 49
- ☐ Removing and installing. Refer to ➤ [B5.4 elt Tensioner", page 62](#).

#### 6 - Sub-Assembly Bracket

- ☐ With Oil Pressure Switch -F1-, oil filter and engine oil cooler
- ☐ Sub-assembly bracket, removing and installing. Refer to ➤ [B5.8 racket", page 76](#).
- ☐ Oil filter, engine oil cooler and oil pressure switch. Refer to ➤ [O4.5 il Pressure Switch F22 ", page 220](#).

#### 7 - Bolt

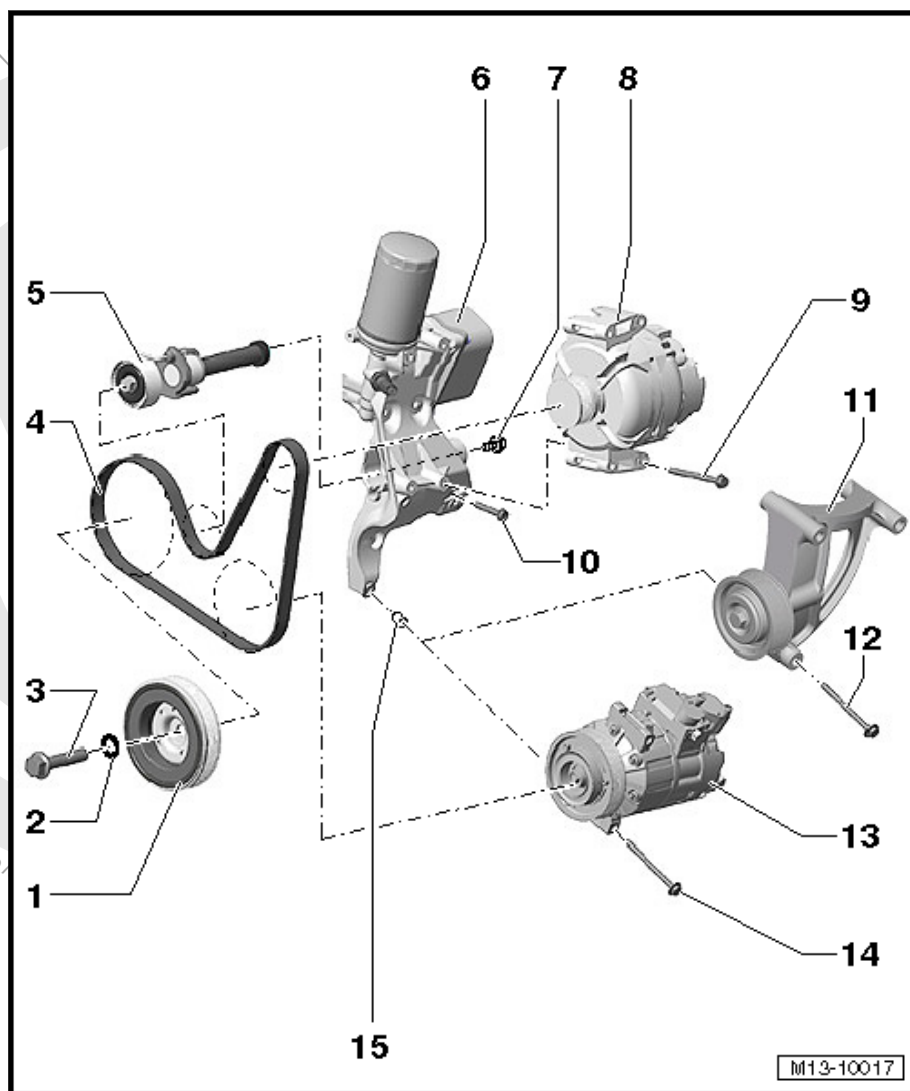
- ☐ 10 Nm

#### 8 - Generator

- ☐ Removing and installing. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Generator; Generator, Removing and Installing.

#### 9 - Bolt

- ☐ 23 Nm





#### 10 - Bolt

- ☐ Tightening sequence and specification. Refer to ➤ Fig. [“Accessory Assembly Bracket - Tightening Sequence and Tightening Specification”](#), page 49 .
- ☐ Always replace

#### 11 - Bracket with Idler Roller

- ☐ For vehicles without air conditioning system

#### 12 - Bolt

- ☐ 25 Nm

#### 13 - Air Conditioning (A/C) Compressor

- ☐ Do not remove or disconnect refrigerant lines
- ☐ Removing and installing. Refer to ➤ Heating, Ventilation and Air Conditioning; Rep. Gr. 87; Removal and Installation.

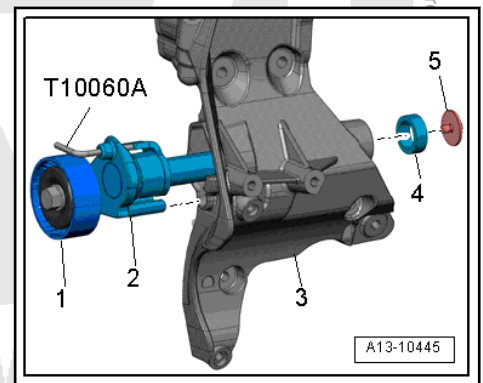
#### 14 - Bolt

- ☐ 25 Nm

#### 15 - Alignment Sleeve

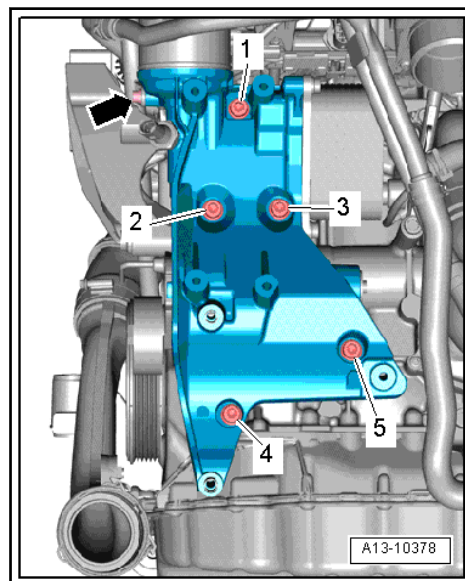
- ☐ For A/C compressor or bracket with idler roller

#### Ribbed Belt Tensioner Individual Components



- 1 - Ribbed belt tensioner
- 2 - Support
- 3 - Sub-assembly bracket
- 4 - Centering bracket
- 5 - Bolt

#### Accessory Assembly Bracket - Tightening Sequence and Tightening Specification



### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Procedure

- Mount the subassembly bracket and then install the bolts -4-.
- Tighten the new bolts in sequence -1 through 5- in 3 steps:
  1. Tighten bolts hand-tight.
  2. Tighten the bolts to 20 Nm.
  3. Turn the bolts an additional 90° (1/4 turn).





### 3 Specifications

⇒ **D3.1 imensions", page 51**

#### 3.1 Crankshaft Dimensions

(Dimensions in mm)

Honing Dimension 1)	Crankshaft Bearing Pin Diameter	Connecting Rod Bearing Pin Diameter
Standard dimension	58.00	47.80

1) The preparation of worn crankshafts is not provided.





## 4 Diagnosis and Testing

⇒ [M4.1 Measuring Axial Play](#), page 52

⇒ [M4.2 Measuring Radial Clearance](#), page 52

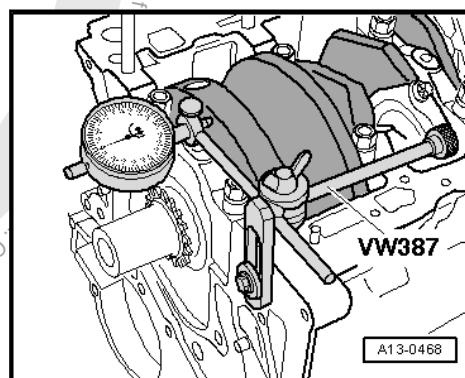
⇒ [M4.3 and Cylinder Bore, Checking](#), page 53

### 4.1 Crankshaft, Measuring Axial Play

Special tools and workshop equipment required

- ◆ Dial Gauge Holder -VW387-
- ◆ Dial Gauge - 0-10mm -VAS6079-

Test Procedure



- Attach the Dial Gauge - 0-10mm -VAS6079- with the Dial Gauge Holder -VW 387- to the cylinder block and set indicator against crankshaft counterweight.
- Press the crankshaft by hand against the Dial Gauge - 0-10mm -VAS6079- and set the Dial Gauge - 0-10mm -VAS6079- to “0”.
- Press crankshaft off the gauge and read the value.

Axial play:

- New: 0.07 to 0.23 mm.
- Wear limit: 0.30 mm.

### 4.2 Crankshaft, Measuring Radial Clearance

Special tools and workshop equipment required

- ◆ Plastigauge®

Conditions

- Do not turn the crankshaft when checking the radial clearance.

Test Procedure



Note

- ◆ Do not interchange used bearings
- ◆ Bearing shells that are worn down to the nickel layer must be replaced.





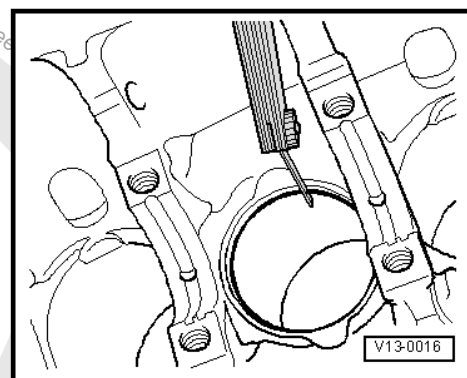
- Remove main bearing cover and clean the bearing cap and pins.
- Place Plastigauge® over entire width of bearing journal or into bearing shells.
  - Plastigauge® must rest in center of bearing shell.
- Position the main bearing cover and tighten it to 60 Nm. Do not rotate the crankshaft when doing so.
- Remove the main bearing cover again.
- Compare the width of the Plastigauge® with measuring scale.

Radial clearance:

- New: 0.017 to 0.037 mm.
- Wear limit: 0.15 mm.

## 4.3 Pistons and Cylinder Bore, Checking

### Checking the Piston Ring Gap



#### Special tools and workshop equipment required

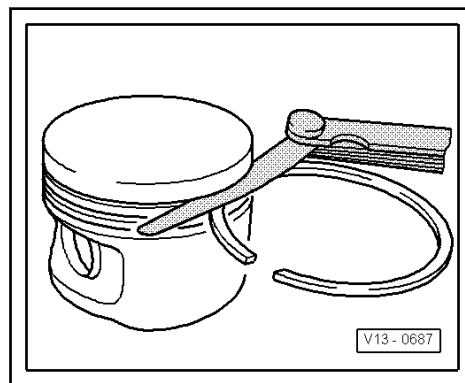
- ◆ Feeler Gauge

#### Test Sequence

- Push ring squarely from above down to approximately 15 mm from bottom end of cylinder. To push in use a piston without rings.

Piston Ring	Gap	
	New	Wear limit
Dimensions in mm		
Compression Rings	0.20 to 0.40	0.80
Oil Scraping Ring	0.25 to 0.50	0.80

#### Piston Ring Groove Clearance, Checking



#### Special tools and workshop equipment required

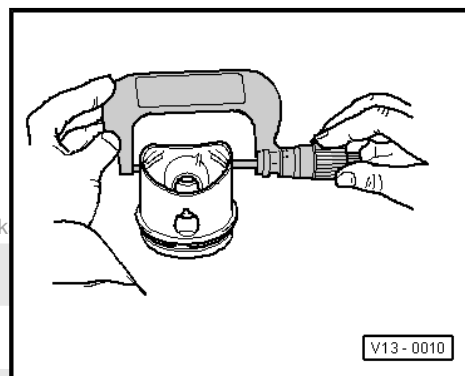
- ◆ Feeler Gauge

#### Test Sequence

- Clean the ring groove of piston before checking.

Piston Ring	Ring To Groove Clearance	
Dimensions in mm	New	Wear limit
1st Compression ring	0.06 to 0.09	0.20
2nd Compression ring	0.03 to 0.06	0.15
Oil scraping ring	cannot be measured	

#### Pistons, Checking



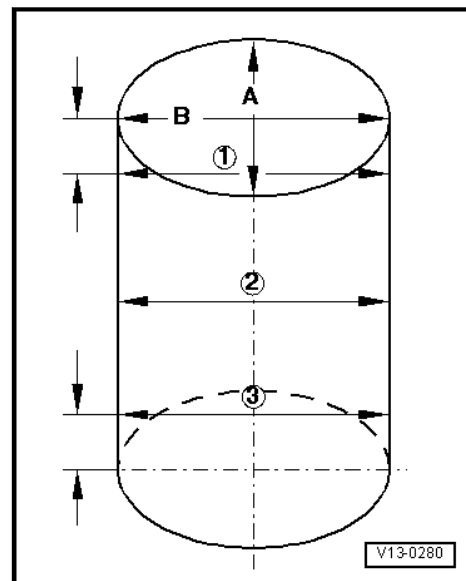
#### Special tools and workshop equipment required

- ◆ Outside Micrometer - 75-100mm - VAS6071-

#### Test Sequence

- Measure pistons approximately 10 mm from the lower edge and offset by 90° to the piston pin axis.
- Deviation from specified size: maximum 0.04 mm

#### Cylinder Bore, Checking



### Special tools and workshop equipment required

- ◆ Cylinder Dial Bore Gauge -VAS6078-



#### Caution

*Do not drill, hone, grind or rework the cylinder bores with shop tools. Reworking damages the surface of the cylinder bore.*

### Test Sequence

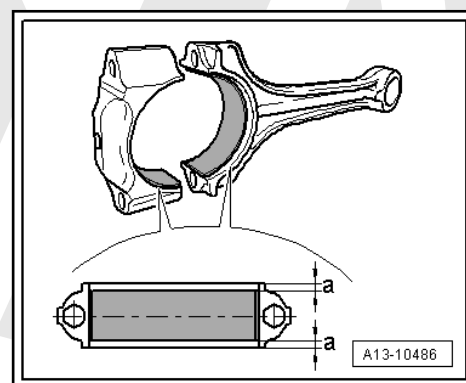
- Measure diagonally at three positions laterally -A- and longitudinally -B-.
- Deviation from nominal dimension: maximum 0.08 mm



#### Note

*The cylinder bore must not be measured when the cylinder block is mounted on the Engine and Transmission Holder - VAS6095- because the measurements may be incorrect.*

### Bearing Shell Installation Position



- Place the bearing shells centrally into connecting rod and connecting rod bearing cap.
- The dimension -a- must be the same at left and right.



### Piston and Cylinder Dimensions

Honing Dimension	Piston and Cylinder Dimensions	
Dimensions in mm	Piston diameter <sup>2)</sup> .	Cylinder bore diameter <sup>2)</sup> .
Standard dimension	82.465	82.510

2) Dimensions without graphite coating (0.020 mm thick). The graphite coating wears off.





## 5 Removal and Installation

⇒ [N5.1 Needle Bearing, Replacing", page 57](#)

⇒ [M5.2 Mass Flywheel", page 58](#)

⇒ [B5.3 Belt", page 60](#)

⇒ [B5.4 Belt Tensioner", page 62](#)

⇒ [F5.6 Slang, Removing and Installing, Transmission Side", page 67](#)

⇒ [W5.7 Wheel", page 75](#)

⇒ [B5.8 Ratchet", page 76](#)

⇒ [D5.9 Camshaft, Removing and Installing", page 78](#)

⇒ [D5.10 Camshaft Sealing Ring, Replacing", page 85](#)

⇒ [P5.5 Piston, Removing and Installing", page 64](#)

### 5.1 Crankshaft Needle Bearing, Replacing

Only vehicles with a DSG® transmission

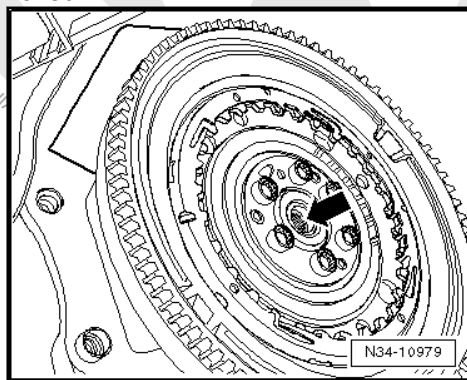
Special tools and workshop equipment required

- ◆ Puller - Kukko Internal - 14-19mm -21/2- and Puller - Kukko Counterstay -22/1-
- ◆ Alignment Tool - Clutch Plate -3176-
- ◆ Bearing Installer - Bearing Press Piece -VW207C-



#### Note

*Always replace the needle bearing -arrow- if the engine or the transmission is being removed.*

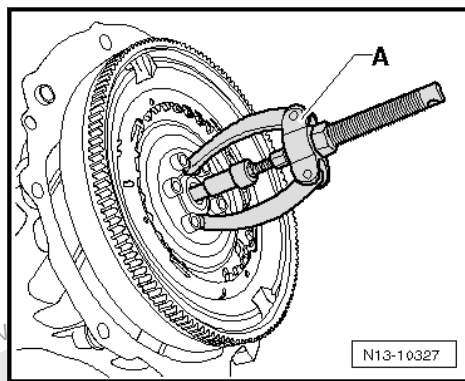


#### Procedure

- The transmission is unflanged from the engine

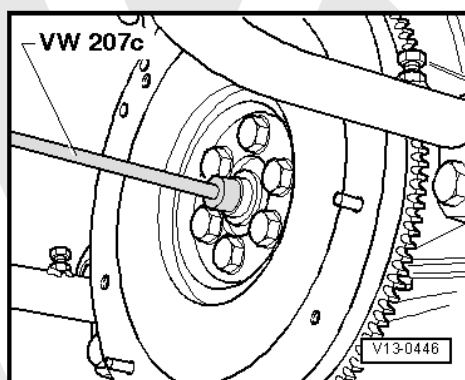
Remove the needle bearing:

- Remove with a commercially available puller -A-, for example Puller - Kukko Internal - 14-19mm -21/2- and Puller - Kukko Counterstay -22/1-.



### Installing

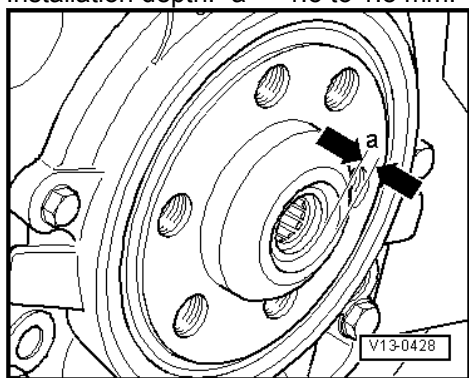
- Needle bearing with Bearing Installer - Bearing Press Piece -VW207C- or with Alignment Tool - Clutch Plate -3176-.



- Carefully install the needle bearing.
- Measure the drive-in depth constantly while installing.

### Replace Bearings That Have Been Installed Too Deep.

- Installation depth: -a- = 1.5 to 1.8 mm.



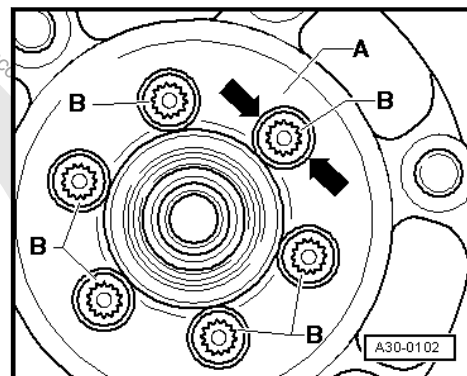
## 5.2 Dual Mass Flywheel

### Special tools and workshop equipment required

- ♦ Flywheel Retainer -3067-

### Removing

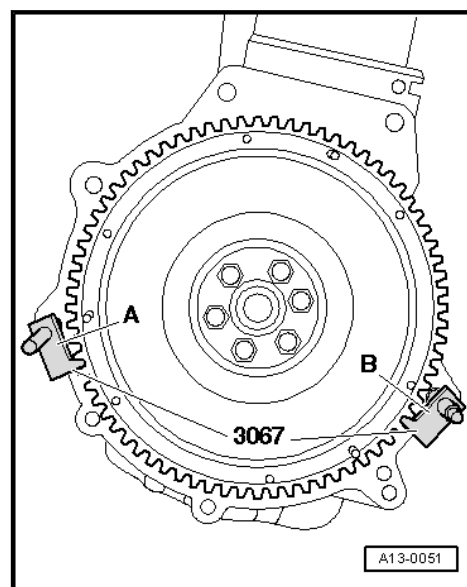
- Remove the transmission. Refer to ⇒ Automatic Transmission; Rep. Gr. 37; Removal and Installation.



### Caution

*To prevent damage to dual-mass flywheel when removing, bolts -B- must not be unscrewed using an air-powered or impact wrench. Always remove the bolt by hand only!*

- Mark the dual-mass flywheel to the engine.
- Rotate the dual-mass flywheel -A- so that the bolts -B- stand centered to the holes -arrows-.
- When removing the bolts -B-, make sure that the bolt head does not contact the dual-mass flywheel -arrows- and cause damage when turning it further.
- Insert the Flywheel Retainer -3067- into the hole on the cylinder block -B-.



- Remove the dual-mass flywheel by hand.

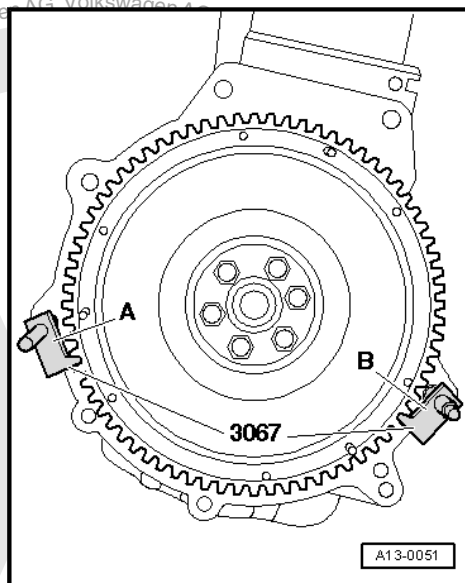
### Installing

Install in reverse order of removal. Note the following:

Tightening specification. Refer to ➔ [-2.2 Cylinder Block, Transmission Side-, page 43](#).

- Secure with new bolts.
- Insert the Flywheel Retainer -3067- into the hole on the cylinder block -A-.





### 5.3 Ribbed Belt

#### Special tools and workshop equipment required

- ◆ Locking Pin -T10060A-

#### Removing

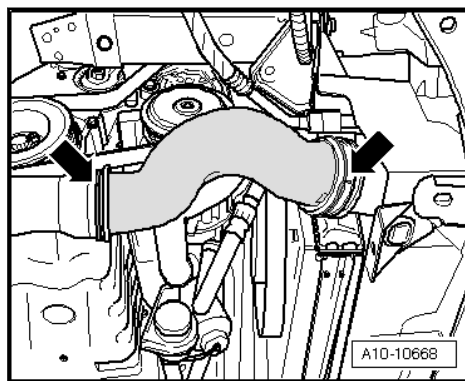


#### Caution

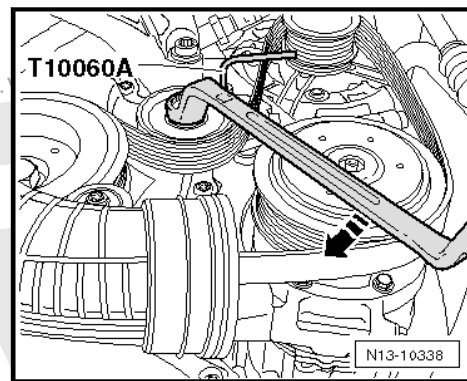
***Risk of damaging due to reversed running direction on a used ribbed belt:***

- ◆ ***Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.***

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the right charge air hose -arrows-.



- To release the tension on the ribbed belt, turn the tensioner in direction of -arrow- from underneath.
- Secure the tensioning system using the Locking Pin - T10060A-.
- Remove the ribbed belt.



## Installing

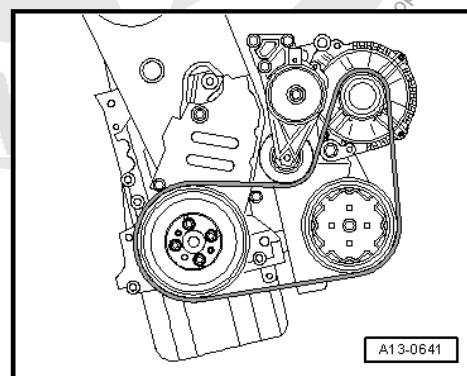
Install in reverse order of removal. Note the following:



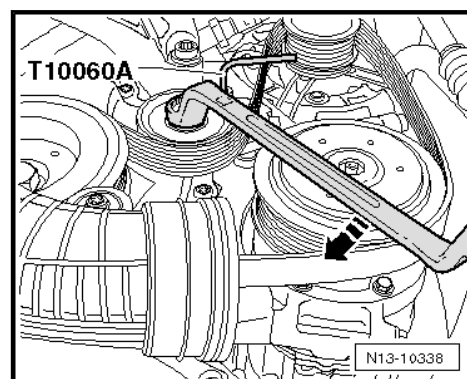
### Note

*Check to make sure the following components are secure before mounting the ribbed belts: the tensioner, generator and Air Conditioning (A/C) compressor or bracket with idler roller.*

- Place the ribbed belts on the on the crankshaft, generator and A/C compressor belt pulleys.



- Turn the tensioner slightly with wrench in direction of -arrow- and remove the Locking Pin -T10060A-.



- Release the tensioner.
- Check whether the ribbed belt is routed correctly.
- Start engine and check whether ribbed belt runs correctly.



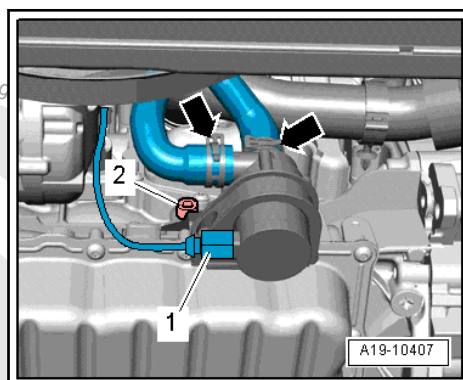
## 5.4 Ribbed Belt Tensioner

### Special tools and workshop equipment required

- ◆ Engine Support Bridge -10-222A-
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13-  
(quantity: 2)
- ◆ Locking Pin -T10060A-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-

### Removing

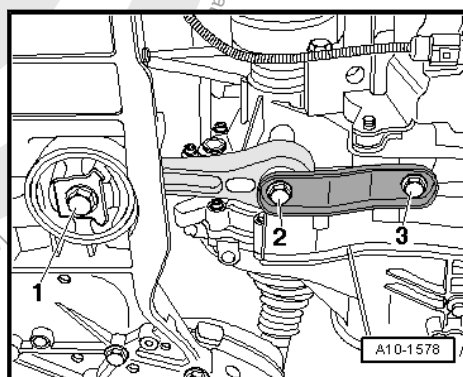
- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove right front wheel.
- Remove the front section of the right wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Remove the bolt -2- on the bracket for the After-Run Coolant Pump -V51-.



### Note

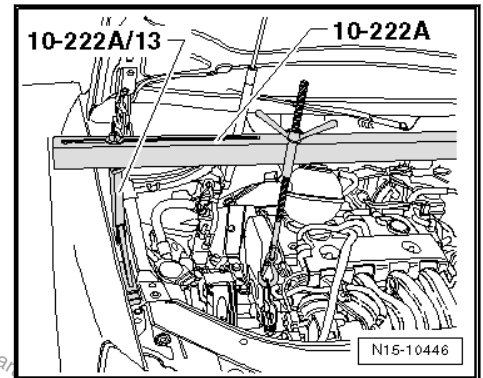
*The After-Run Coolant Pump -V51- stays in the installed position.*

- First unscrew bolt -1-.

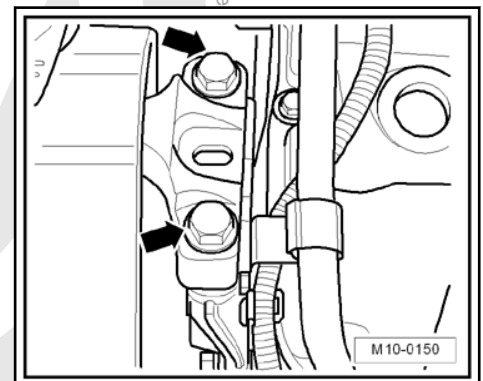




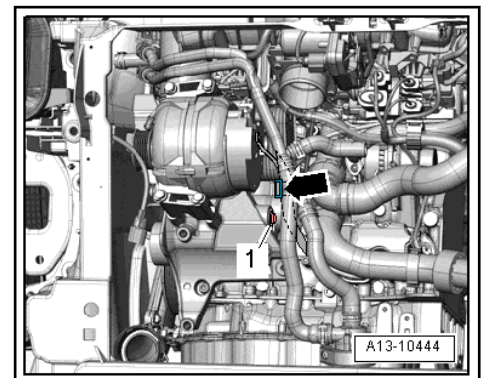
- Remove the bolts -2 and 3- and remove the pendulum support.
- If equipped, remove the charge air guide to the sound generator.
- Mount the Engine Support Bridge -10-222A- with the following tools:



- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13- (quantity: 2)
- Tension the engine with the spindle.
- Remove the ribbed belt. Refer to ➤ [B5.3 elt", page 60](#).
- Remove the subframe bolts -arrows- on the engine.



- Lower the engine approximately 55 mm.
- Free up the wiring harness -arrow-



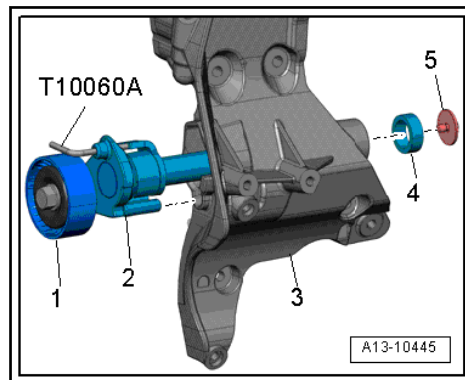


- Remove the bolt -1- and remove the ribbed belt tensioner from the accessory assembly bracket.

### Installing

Install in reverse order of removal. Note the following:

- ◆ Tightening specification. Refer to ⇒ [-2.4 Ribbed Belt Drive](#), [page 47](#).
- ◆ Tightening specifications. Refer to ⇒ [-1.1 Subframe Mount](#), [page 9](#).
- Insert the ribbed belt tensioner -1- into the sub-assembly bracket -3- and tighten the bolt -5-.

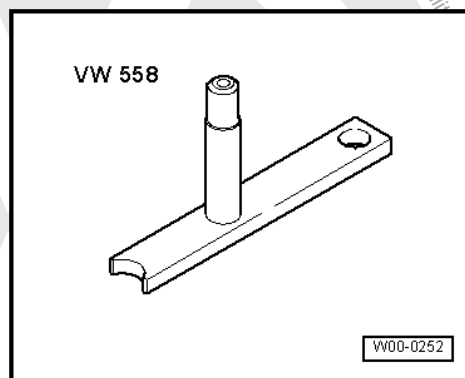


- ◆ Note the installation position of the support -2-: Insert the tabs on the support into the hole in the sub-assembly bracket.
- ◆ Pay attention to the centering sleeve -4-.
- Adjust the subframe mount. Refer to ⇒ [M1.2 Mount Adjusting](#), [page 11](#).

## 5.5 Drive Plate, Removing and Installing

### Special tools and workshop equipment required

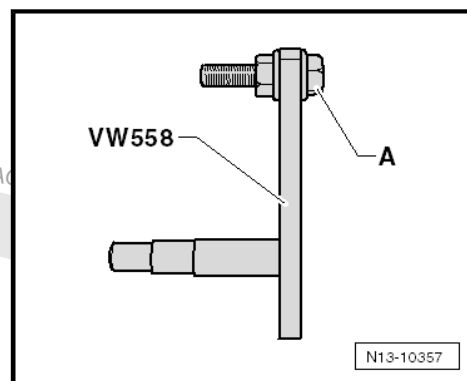
- ◆ Flywheel Lock Adapter -VW 558-



- ◆ Depth Gauge
- ◆ M8x40 hex bolt and M8 hex nut
- Remove the transmission. Refer to ⇒ Rep. Gr. 37; Transmission, Removing and Installing.

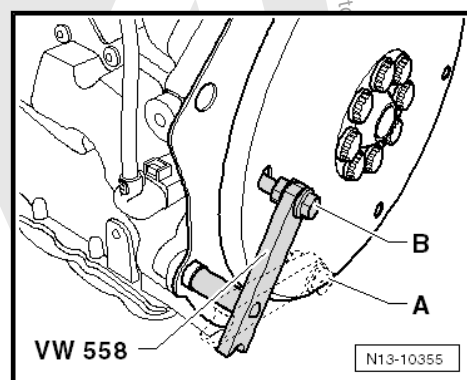
### Flywheel Lock Adapter -VW 558-, Preparing:

- Tighten the M8x40 hex bolt -A- with a hex nut on the Flywheel Lock Adapter -VW 558-.



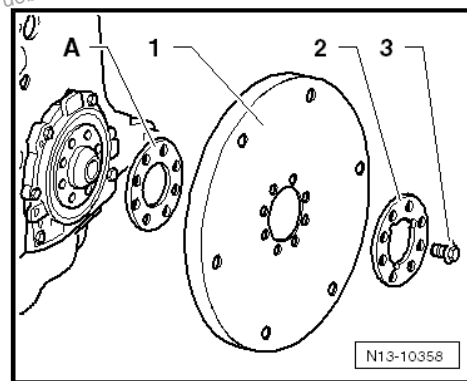
### Drive Plate, Loosening and Tightening:

- Insert the Flywheel Lock Adapter -VW 558- into the cylinder block and drive plate as shown.

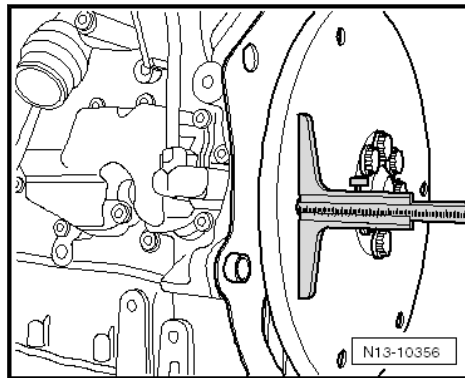


Counterhold tool installation position: -A- to loosen, -B- to tighten.

### Drive Plate, Installing:



- First position the drive plate without the washer -A-.
- Insert the used bolts -3- and tighten them to 30 Nm.
- Check the dimension between the drive plate and the cylinder block in three locations and calculate the average.



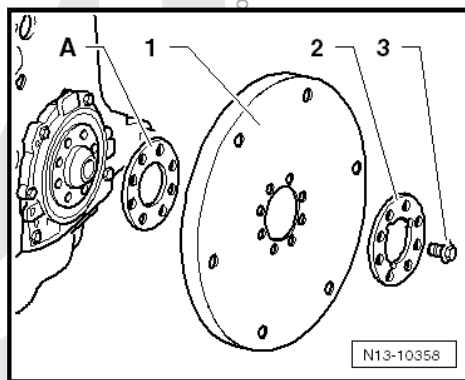
#### Note

*This is measured through the hole in the drive plate to the machined surface of the cylinder block. When measuring on the intermediate plate, take the thickness of the plate into consideration.*

- Specified value measured without intermediate plate: 19.5 to 21.1 mm
- Specified value measured with intermediate plate: 18.8 to 20.4 mm

If the specified value is reached, replace all bolts and tighten them.

If the specified value is not obtained:



- Remove the drive plate again and use the shim -A-. Tighten the bolts -3- to 30 Nm again.
- Repeat the measurement. If the specified value is reached, replace all bolts and tighten them.
- Tightening specification -item 6- ➔ [Item 6 \(page 44\)](#) .



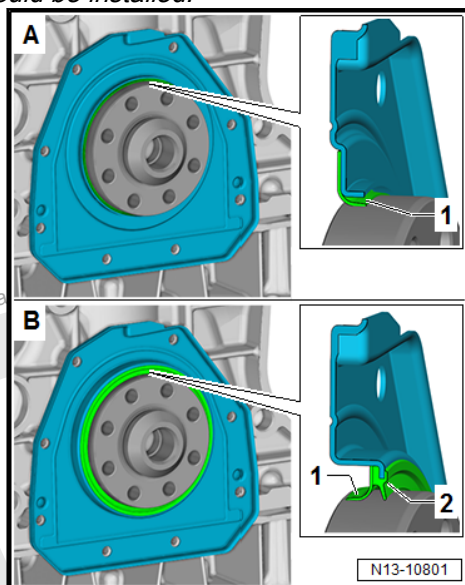


## 5.6 Sealing Flange, Removing and Installing, Transmission Side



### Note

There are two versions of the sealing flange. Please check which sealing flange should be installed.



- ◆ Version -A-: sealing lip -1- faces the transmission (air side).
- ◆ Version -B-: sealing lip -1- faces the engine (oil side). This sealing flange also has a dust lip -2-.

Version -A-, Removing and Installing. Refer to [⇒ S5.6.1 ide Sealing Flange, Removing and Installing, Version A \(Air Side Sealing Lip\)](#)", page 67 .

Version -B-, Removing and Installing. Refer to [⇒ S5.6.2 ide Sealing Flange, Removing and Installing, Version B \(Oil Side Sealing Lip\)](#)", page 70 .

### 5.6.1 Transmission Side Sealing Flange, Removing and Installing, Version A (Air Side Sealing Lip)

Special tools and workshop equipment required

- ◆ Seal Installer - Sealing Flange Guide Sleeve -T20097-



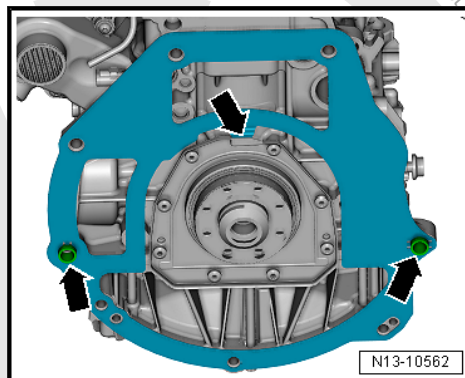
- ◆ Hand drill with plastic brush insert



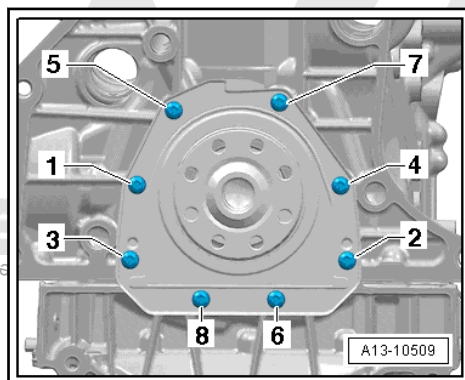
- ◆ Protective Eyewear
- ◆ Refer to the ➔ Electronic Parts Catalog (ETKA) for the correct sealant.

### Removing

- The transmission is removed.
- Dual-mass flywheel removed (refer to ➔ [M5.2 ass Flywheel", page 58](#) ) or drive plate removed (refer to ➔ [P5.5 late, Removing and Installing", page 64](#) ).
- Unhook the intermediate plate from the sealing flange and at the alignment sleeves -arrows-.



- Remove the bolts -1 through 8-.



- Remove the sealing flange.

### Installing



#### Note

- ◆ Check the expiration date of the silicone sealant.
- ◆ The sealing flange must be installed within five minutes of applying the silicone sealant.
- ◆ To prevent contamination of the lubricating system with sealant residue, place a clean cloth over the open part of the oil pan.

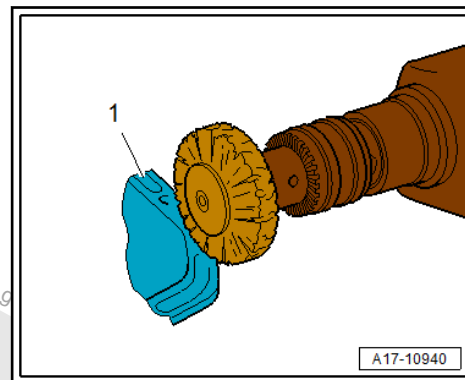


### Caution

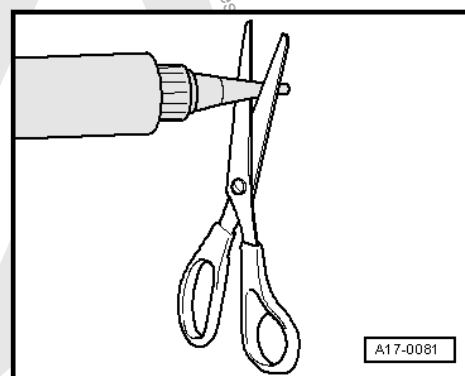
*Risk of injuring the eyes from sealant residue.*

◆ *Wear protective eyewear.*

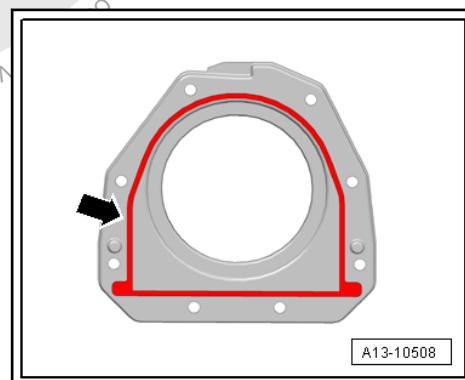
- Remove any remaining sealant from the cylinder block using, for example, a rotating plastic brush.



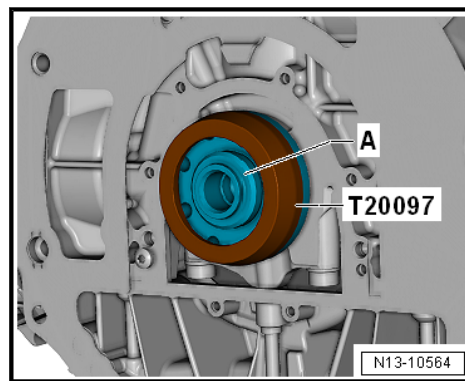
- Clean the sealing surfaces. They must be free of oil and grease.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).



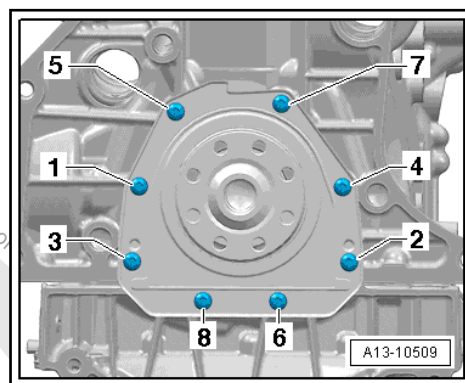
- Apply silicone sealant to the clean sealing surface on the sealing flange as shown.



- ◆ Sealant bead thickness: 2 to 3 mm.
- Clean the crankshaft journal carefully.



- Check the Guide Sleeve; it must not be widened, sharp-edged or dirty.
- Position the Seal Installer - Sealing Flange Guide Sleeve -T20097- on the crankshaft journal -A-.
- Slide the sealing flange onto the crankshaft journal using the Seal Installer - Sealing Flange Guide Sleeve -T20097-.
- Remove the Seal Installer - Sealing Flange Guide Sleeve -T20097-.
- Tighten the new bolts evenly in the sequence shown:



Step	Bolts	Tightening Specification/Additional Turn
1.	-1 to 8-	Install all the way by hand
2.	-1 to 8-	9 Nm



#### Note

After installing the sealing flange, the sealant must dry for approximately 30 minutes. Only afterward may the engine oil be replenished.

Further assembly is performed in the reverse order of the removal.

#### Tightening Specifications

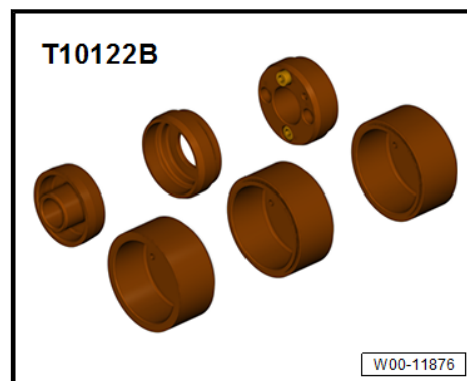
- ♦ Refer to ➤ [-2.2 Cylinder Block, Transmission Side](#), page 43

### 5.6.2 Transmission Side Sealing Flange, Removing and Installing, Version B (Oil Side Sealing Lip)

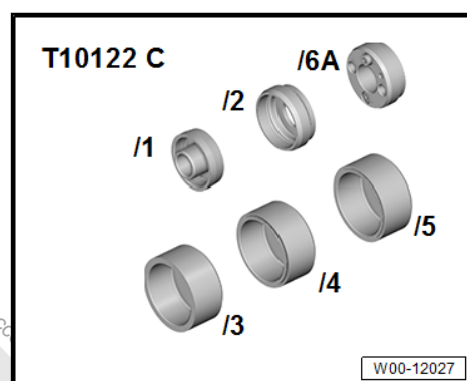
Special tools and workshop equipment required



- ◆ Crank Shaft Seal Installer - Guide Piece -T10122/6- or -T10122/6A- from the Seal Installer - Crankshaft -T10122B- or -T10122C-



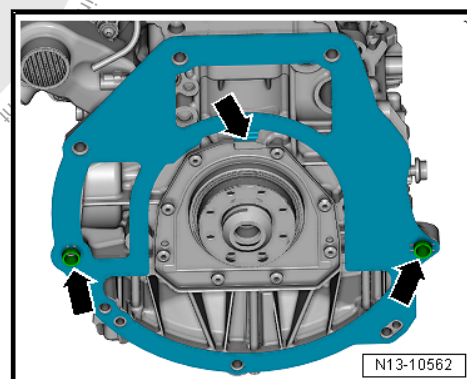
- ◆ Guide Piece to Crankshaft Seal Install Kit - Guide Piece -T10122/1- from the Seal Installer - Crankshaft -T10122B- or -T10122C-



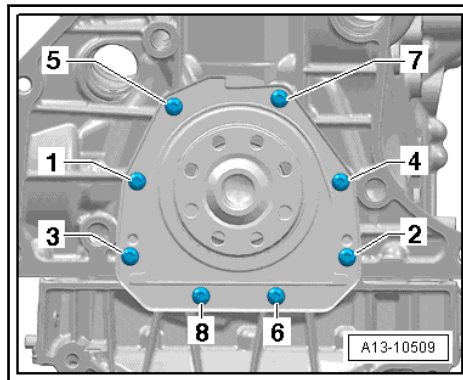
- ◆ Hand drill with plastic brush insert
- ◆ Protective Eyewear
- ◆ Refer to the ⇒ Electronic Parts Catalog (ETKA) for the correct sealant.

### Removing

- The transmission is removed.
- Dual-mass flywheel removed (refer to ⇒ [M5.2 ass Flywheel", page 58](#) ) or drive plate removed (refer to ⇒ [P5.5 late, Removing and Installing", page 64](#) ).
- Unhook the intermediate plate from the sealing flange and at the alignment sleeves -arrows-.



- Remove the bolts -1 through 8-.



- Pry out the sealing flange.

### Installing



#### Note

- ◆ Check the expiration date of the silicone sealant.
- ◆ The sealing flange must be installed within five minutes of applying the silicone sealant.
- ◆ To prevent contamination of the lubricating system with sealant residue, place a clean cloth over the open part of the oil pan.

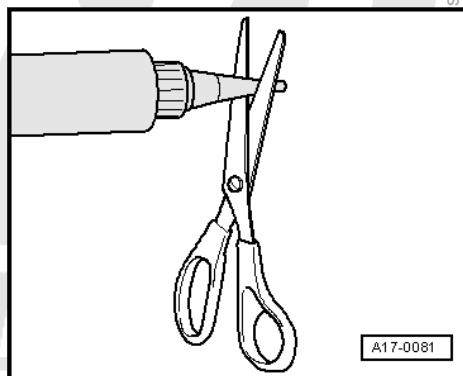


#### Caution

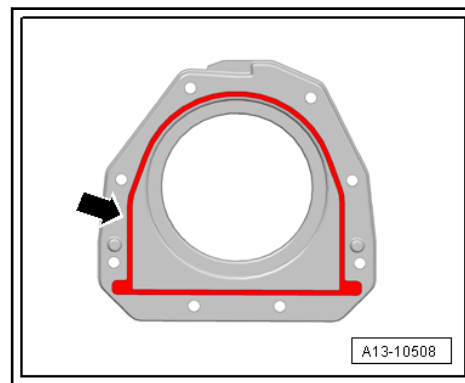
**Risk of injuring the eyes from sealant residue.**

- ◆ Wear protective eyewear.

- Remove the sealant residue on the cylinder block using a flat-blade scraper or a rotating plastic brush.
- Clean the sealing surfaces. They must be free of oil and grease.
- Clean the crankshaft journal. When there is rust on the crankshaft journal, apply a thin coat of engine oil.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).



- Apply silicone grease as shown to the clean sealing surface of the sealing flange.

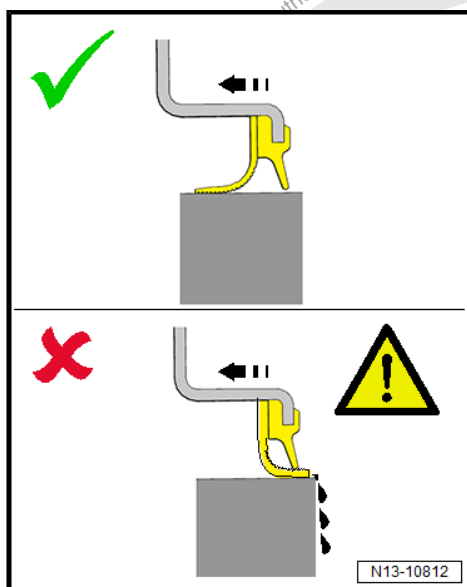


- ◆ Sealant bead thickness: 2 to 3 mm.



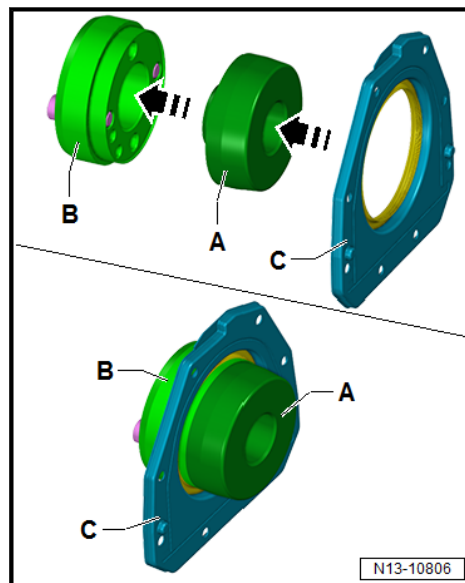
#### Note

- ◆ The sealing flange must be installed within five minutes after applying the silicone sealant.
- ◆ The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.
- ◆ Check the sealing lip of the sealing flange, it must not be kinked or damaged.
- ◆ The sealing lip must be pointed to the engine after installing. If the sealing lip »folds« outward when installing, leaks will result.

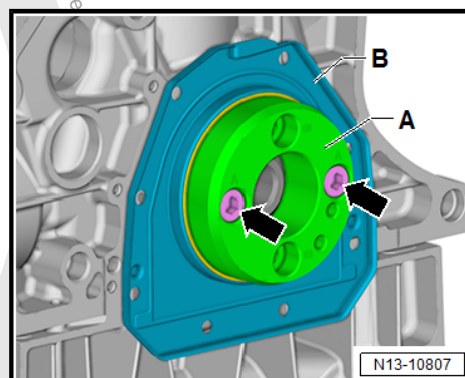


- Check the Crank Shaft Seal Installer - Guide Piece - T10122/6A- -(B)-; it must not be tilted or contaminated.

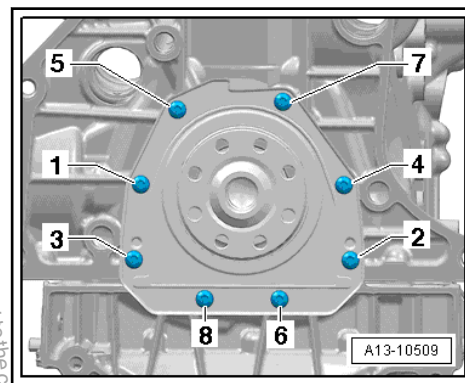




- Mount the Guide Piece to Crankshaft Seal Install Kit - Guide Piece -T10122/1- (A)- on the Crank Shaft Seal Installer - Guide Piece -T10122/6A- -(B)-.
- Slide the sealing flange -C- on the Guide Piece -B- with the outer side on it.
- Remove the Guide Piece -A-.
- Insert the Guide Rod -A- with the sealing flange -B- on the crankshaft journal.



- It is not necessary to tighten the bolts -arrows-
- Slide the Sealing Flange -B- over the Guide Piece -A- on the crankshaft journal.
- Remove the Guide Piece -A-.
- Tighten the new bolts evenly in the sequence shown:



Step	Bolts	Tightening Specification/Additional Turn
1.	-1 to 8-	Install all the way by hand
2.	-1 to 8-	9 Nm



#### Note

After installing the sealing flange, the sealant must dry for approximately 30 minutes. Only afterward may the engine oil be replenished.

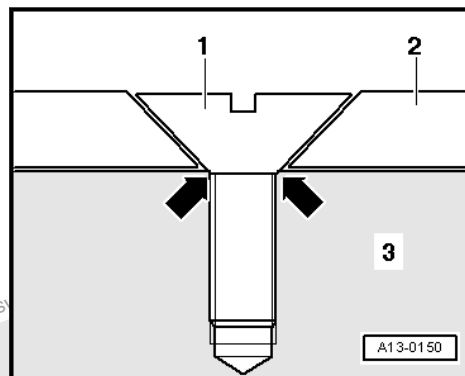
Further assembly is performed in the reverse order of the removal.

#### Tightening Specifications

- ◆ Refer to ➤ [-2.2 Cylinder Block, Transmission Side”, page 43](#)

### 5.7 Sensor Wheel

- Remove the engine. Refer to ➤ [R3.2 emoving”, page 18](#) .
- Remove the transmission side sealing flange. Refer to ➤ [F5.6 lange, Removing and Installing, Transmission Side”, page 67](#) .
- Remove the oil pan upper section. Refer to ➤ [P4.3 an Upper Section”, page 215](#) .
- Remove the balance shaft timing chain. Refer to ➤ [S3.1 haft Drive Chain”, page 115](#) .
- Remove the connecting rod bearing cap -Item 2- ➤ [Item 2 \(page 46\)](#)
- Remove the crankshaft bearing cap -Item 6- ➤ [Item 6 \(page 42\)](#) .
- Remove the crankshaft and the sensor wheel.
- Always replace sensor wheel -2- whenever bolts are removed -1-.



#### Note

- ◆ After tightening a second time, the attachment point of the countersunk bolts of the sensor wheel are so deformed that the bolt heads lie on the crankshaft -3- -arrows- and the sensor wheel is loose underneath the bolts.
- ◆ Installation of sensor wheel is only possible in one position - the bores are offset.
- Tightening specification. Refer to ➤ [-2.1 Crankshaft](#), page [41](#)

## 5.8 Sub-Assembly Bracket

### Special tools and workshop equipment required

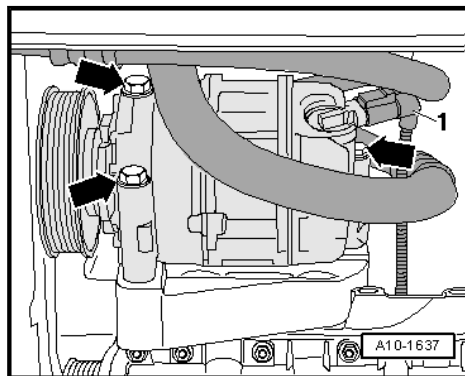
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Coolant Additive -G 12 plus-plus-

### Removing

- Drain the coolant. Refer to ➤ [D1.1 draining and Filling](#), page [229](#).
- Remove the ribbed belt. Refer to ➤ [B5.3 elt](#), page [60](#).
- If equipped, remove the charge air guide to the sound generator.
- Remove the Generator. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Removal and Installation.
- Disconnect the connector from the oil pressure switch or from the oil pressure switches.

### Vehicles with Air Conditioning

- Disconnect solenoid clutch electrical connector -1- on Air Conditioning (A/C) compressor.





#### WARNING

***Risk of injury from refrigerant:***

- ◆ ***Do not open the A/C system refrigerant circuit.***

- Remove the A/C compressor bolts -arrows-.



#### Caution

***There is a risk of damaging the refrigerant lines and hoses.***

- ◆ ***Do not bend, twist or stretch the refrigerant lines and hoses.***

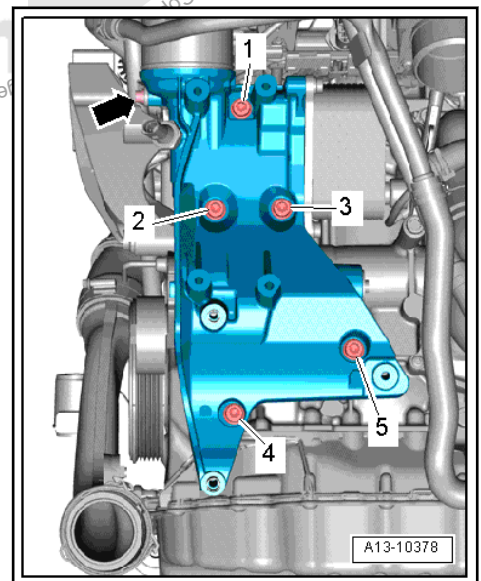
- Tie up the A/C compressor to the longitudinal member with the refrigerant hoses still connected.

#### Vehicles without A/C

- Remove the bracket and idler roller.

#### Continuation for All Vehicles

- Remove the oil dipstick guide tube bolt -arrow-.
- Remove the bolts -5 through 1- and remove the accessory assembly bracket from the coolant pump housing.



#### Installing

Install in reverse order of removal. Note the following:

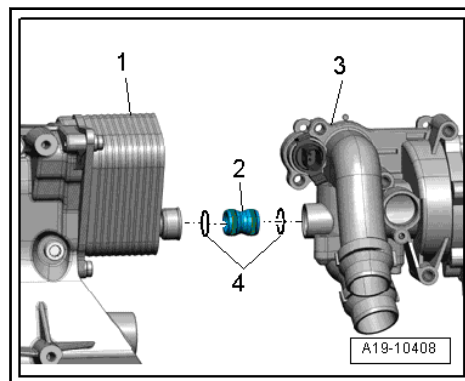


#### Note

- ◆ ***Tightening specifications. Refer to ➤ -2.4 Ribbed Belt Drive-, page 47.***
- ◆ ***Replace the bolts that were tightened with an additional turn.***
- ◆ ***Replace the O-rings and seals.***



- Coat the new O-rings -4- with Coolant Additive -G 12 plus-plus-.



- Install the connection -2- into the coolant pump housing -3-.
- Slide the auxiliary components bracket -1- onto the connection and then install and tighten the bolts. Refer to ➤ [Fig. "Accessory Assembly Bracket - Tightening Sequence and Tightening Specification"](#), page 49 .

#### Vehicles with A/C

- Install the A/C compressor. Refer to ➤ Heating, Ventilation and Air Conditioning; Rep. Gr. 87.

#### Vehicles without A/C

- Install the bracket with idler roller. Refer to ➤ [-2.4 Ribbed Belt Drive](#), page 47 .

#### Continuation for All Vehicles

- Install the Generator. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Generator; Generator, Removing and Installing.
- Install the ribbed belt. Refer to ➤ [B5.3 elt](#), page 60 .
- Fill with coolant. Refer to ➤ [D1.1 raining and Filling](#), page 229 .

## 5.9 Vibration Damper, Removing and Installing

### Special tools and workshop equipment required

- ◆ Locking Pin -T10060A-
- ◆ Counterhold - Vibration Damper -T10355A-
- ◆ Vibration Damper Assembly Tool -T10531-

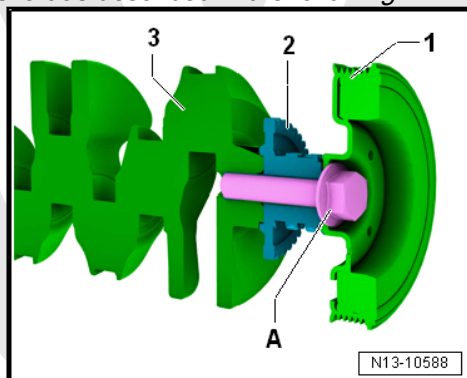
Individual components of the Vibration Damper Assembly Tool -T10531-:

- ◆ Vibration Damper Assembly Tool - Counterhold Tool - T10531/1-
- ◆ Vibration Damper Assembly Tool - Tensioning Pins - T10531/2-
- ◆ Vibration Damper Assembly Tool - Turning Over Tool - T10531/3-
- ◆ Vibration Damper Assembly Tool - Knurled Nut -T10531/4-



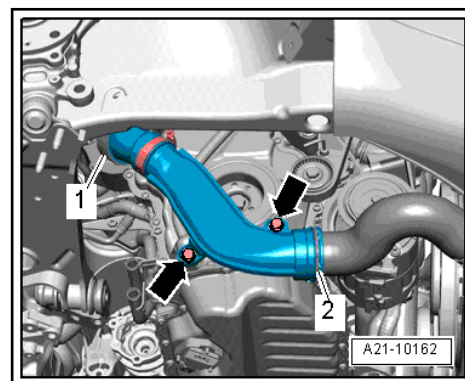
## Note

The vibration damper bolt -A- connects the vibration damper -1-, the timing chain sprocket -2- and the crankshaft -3- with each other. Before removing the bolt, the chain sprocket must be secured to the crankshaft as described in the following.



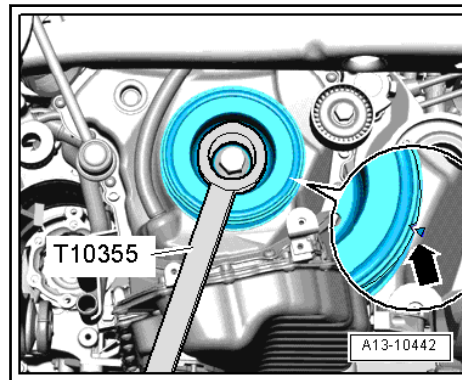
## Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66; Noise Insulation; Noise Insulation, Removing and Installing.
- Remove right front wheel.
- Remove the right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66; Wheel Housing Liner; Front Wheel Housing Liner, Removing and Installing.
- Remove the bolts -arrows-.



- Remove the air duct pipe by lifting the clamps -1 and 2-.
- Remove the ribbed belt. Refer to ⇒ [B5.3 elt", page 60](#) .
- Remove the Locking Pin -T10060A- from the ribbed belt tensioner.
- Rotate the vibration damper using the Counterhold - Vibration Damper -T10355- into the "TDC" position -arrow-.





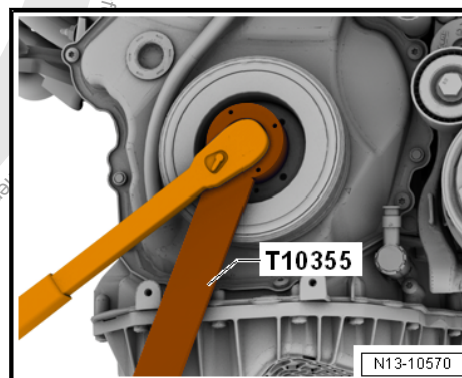
- The notch on the vibration damper must line up with the arrow marking on the lower timing chain cover.
- The marking on the cover is located in the »four-o'clock position«.



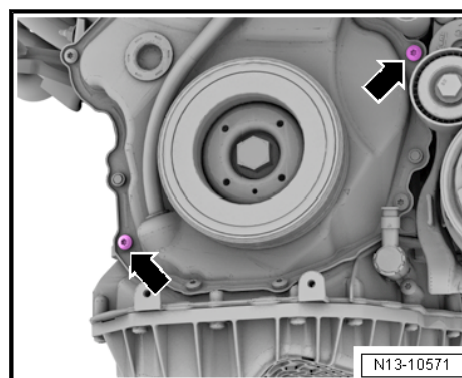
#### Caution

*The bolt for the vibration damper can only be loosened maximum  $\frac{1}{2}$  turn.*

- Loosen the vibration damper bolt approximately  $\frac{1}{2}$  turn by using the Counterhold - Vibration Damper - T10355-.

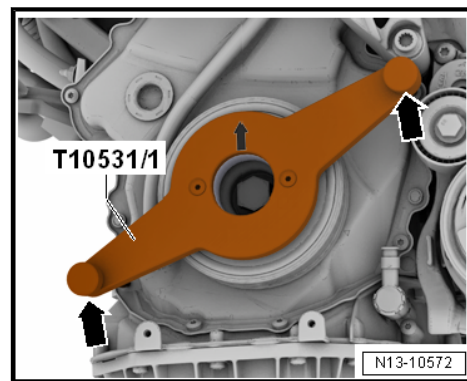


- If the vibration damper is turned, correct it to the TDC point.
- Remove the two bolts -arrows- shown for the timing chain cover. The bolts must be replaced.

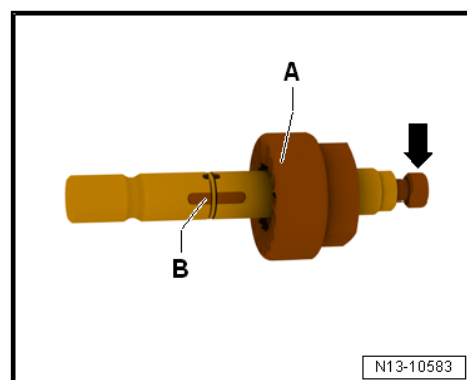


- Place the Vibration Damper Assembly Tool - Counterhold Tool - T10531/1- as shown on the vibration damper and tighten it hand-tight using the knurled bolts -arrows-.





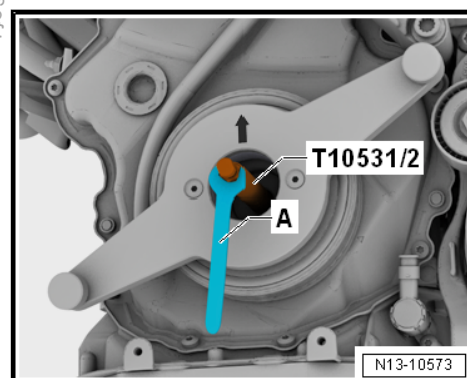
- Remove the vibration damper bolt completely.
- Check if the Turning Over Tool -A- can be easily pushed over the clamping piece -B-. Turn the tensioning bolt -arrow-.



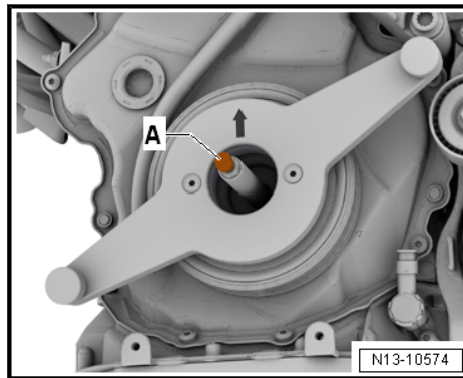
#### Note

*Do not turn the adjusting bolt any more, otherwise the Vibration Damper Assembly Tool - Tensioning Pin -T10531/2- becomes jammed in the crankshaft when installing.*

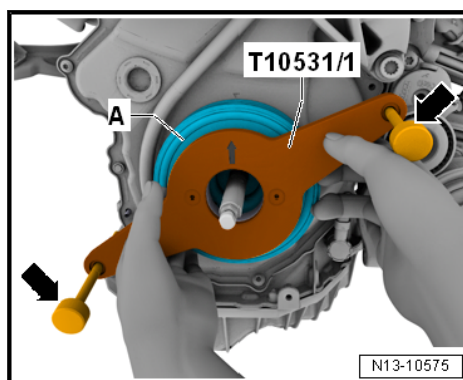
- Install the Vibration Damper Assembly Tool - Tensioning Pin -T10531/2- in the crankshaft and tighten it hand-tight using a 12 mm open end wrench -A-.



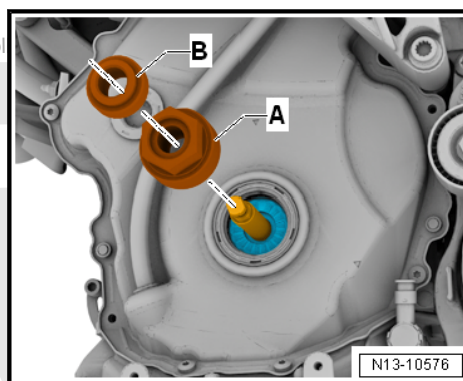
- Tighten tensioning bolt -A- hand-tight. The chain sprocket is secured to the crankshaft as a result.



- Remove the knurled bolts -arrows-. Remove the Vibration Damper Assembly Tool - Counterhold Tool -T10531/1- and vibration damper -A-.



**In the Crankshaft Should Be Turned without the Vibration Damper:**

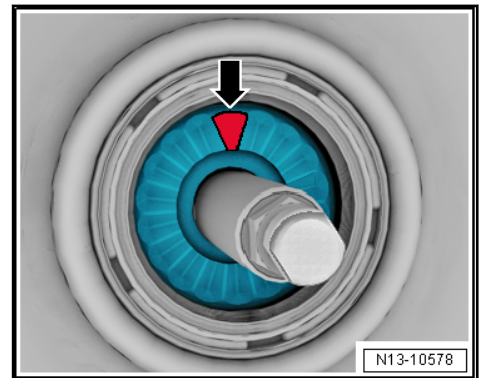
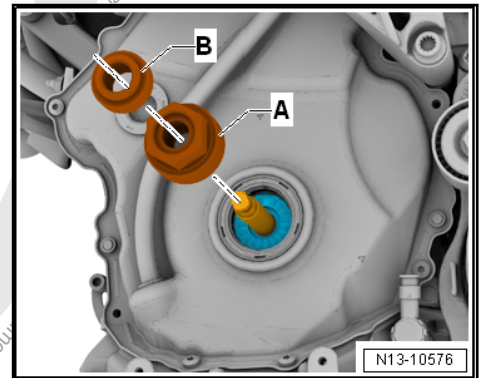
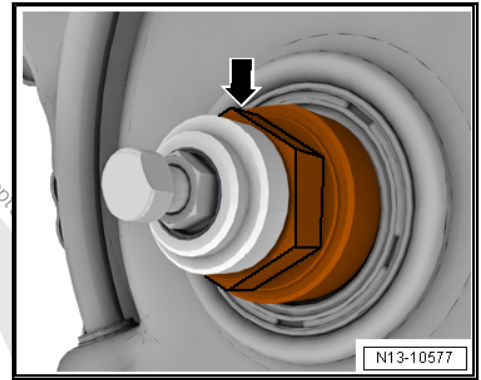


- Place the Vibration Damper Assembly Tool - Turning Over Tool -A- on the tensioning pin. While doing so, pay attention to the chain sprocket tooth contour. The flat side of the tool is at the top in TDC. Tighten the Vibration Damper Assembly Tool - Turning Over Tool with the Collar Nut -B-.
- The crankshaft can now be turned at the hex fitting -arrow-.

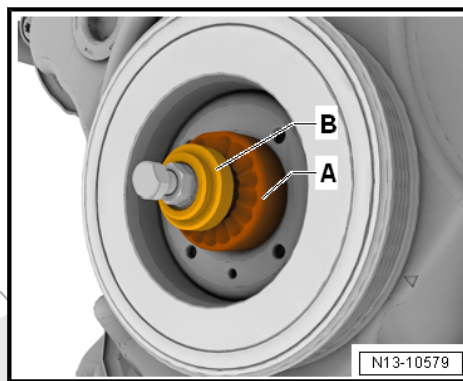


### Vibration Damper, Installing:

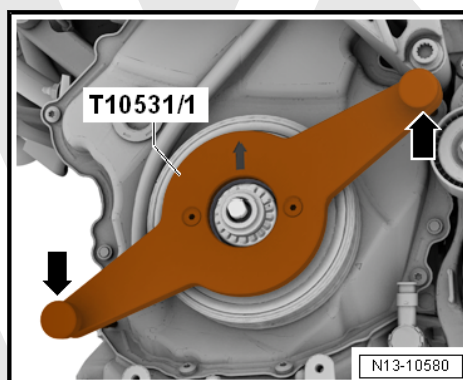
- If necessary, remove the Collar Nut -B- and the Vibration Damper Assembly Tool - Turning Over Tool -A- from the tensioning pin.
- Attach the vibration damper in TDC. While doing so, pay attention to the tooth contour of the chain sprocket -arrow-.



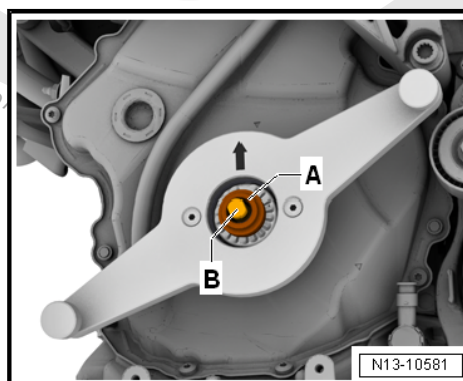
- Place the Assembly Tool - Turning Over Tool -A- on the tensioning pins the at the same time the hex fitting points to the vibration damper. Install the Collar Nut -B-, while doing this move the vibration damper slightly back and forth, to check in the vibration damper is correctly in the tooth contour. Tighten the collar nut until the vibration damper can no longer be turned.



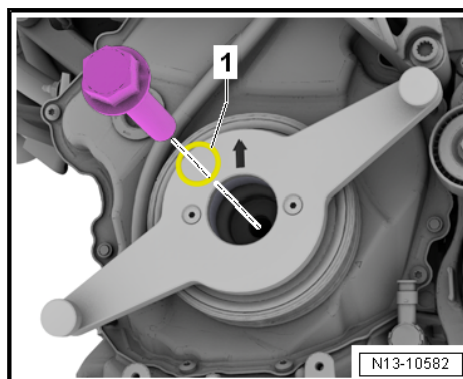
- Place the Vibration Damper Assembly Tool - Counterhold Tool -T10531/1- as shown on the vibration damper and tighten it hand-tight using the knurled bolts -arrows-.



- Remove the Collar Nut -A- and loosen the adjusting bolt -B-. Remove the Tensioning Pin with the Assembly Tool - Turning Over Tool.



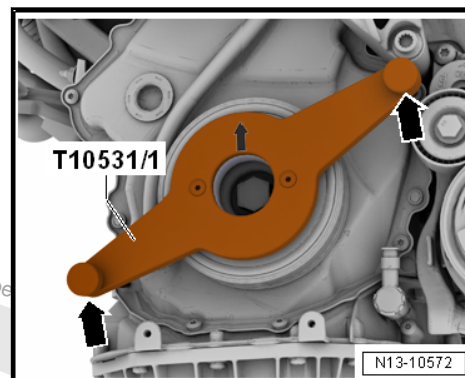
- Install a new vibration damper bolt with oiled O-ring -1- hand-tight.



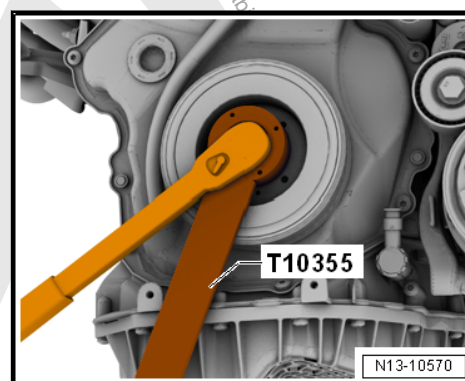




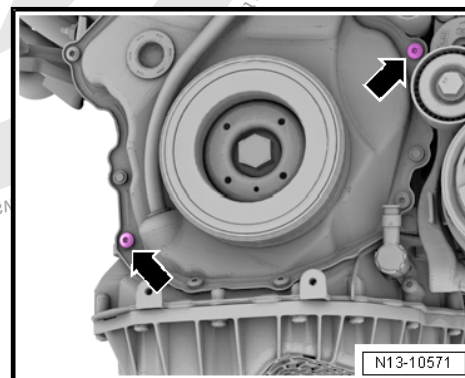
- Remove the knurled bolts -arrows- and remove the Vibration Damper Assembly Tool - Counterhold Tool -T10531/1-.



- Tighten the vibration damper bolt using the Counterhold - Vibration Damper -T10355-.



- Install the new bolts -arrows-.



Further assembly is performed in the reverse order of the removal.

#### Tightening Specifications

- ◆ Refer to ➔ [-2.4 Ribbed Belt Drive”, page 47](#)

### 5.10 Vibration Damper Sealing Ring, Replacing

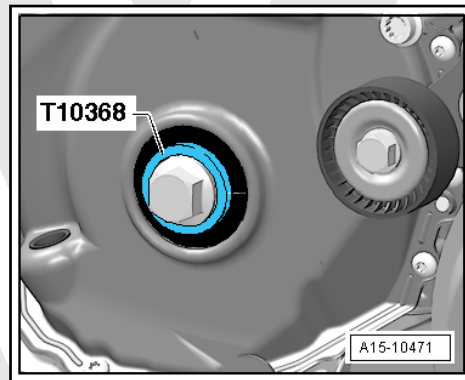
#### Special tools and workshop equipment required

- ◆ Seal Installer - Crankshaft -T10354-
- ◆ Puller - Crankshaft/Power Steering Seal 2 -T20143/2-
- ◆ Press Piece - Timing Chain Cover -T10368-



## Removing

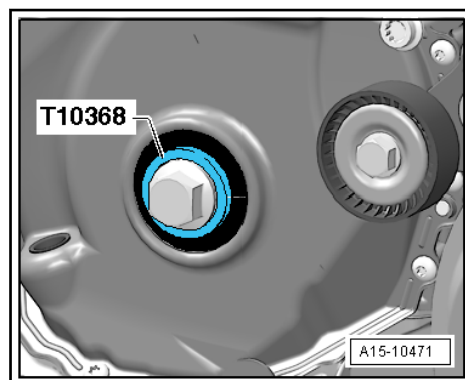
- Remove the vibration damper. Refer to ➤ [D5.9 damper, Removing and Installing](#), page 78 .
- Attach the Press Piece - Timing Chain Cover -T10368- for this.



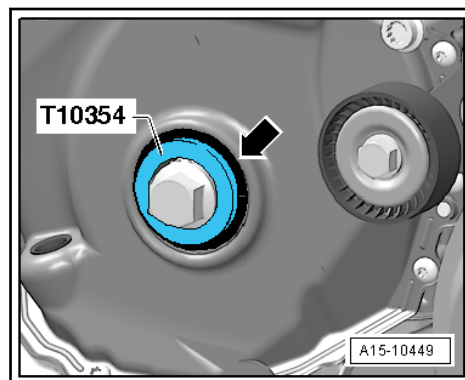
- Remove the gasket with the Puller - Crankshaft/Power Steering Seal 2 - T20143/2-

## Installing

- ♦ Tightening specifications. Refer to ➤ [-2.4 Ribbed Belt Drive](#), page 47 .
- Clean the running and sealing surface.
- Remove the Press Piece - Timing Chain Cover -T10368-.



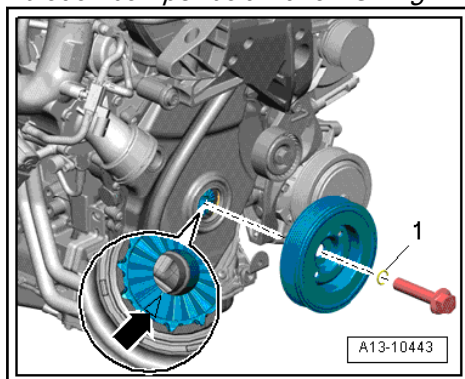
- Insert the gasket -arrow- using the Seal Installer - Crankshaft -T10354- and the vibration damper bolt in all the way.





#### Note

*Replace the vibration damper bolt with an O-ring -1-.*



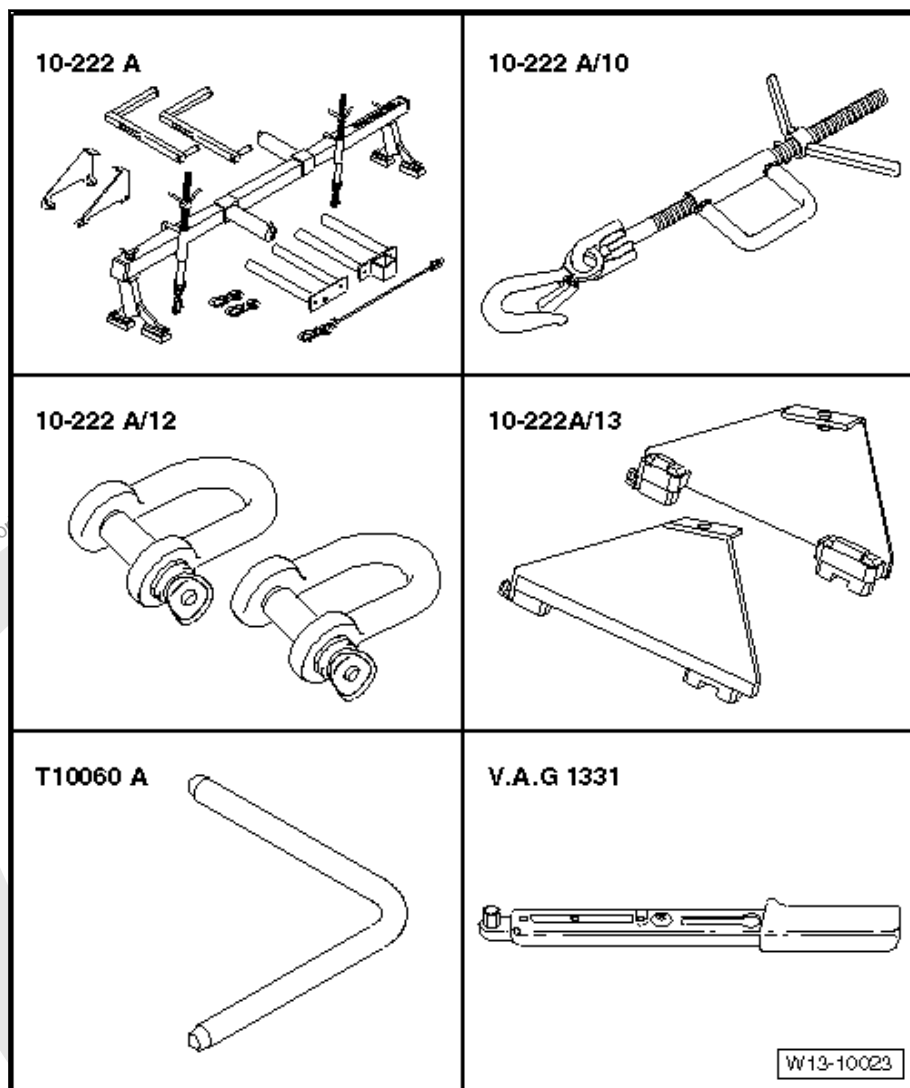
Further assembly is performed the reverse order of the removal.





## 6 Special Tools

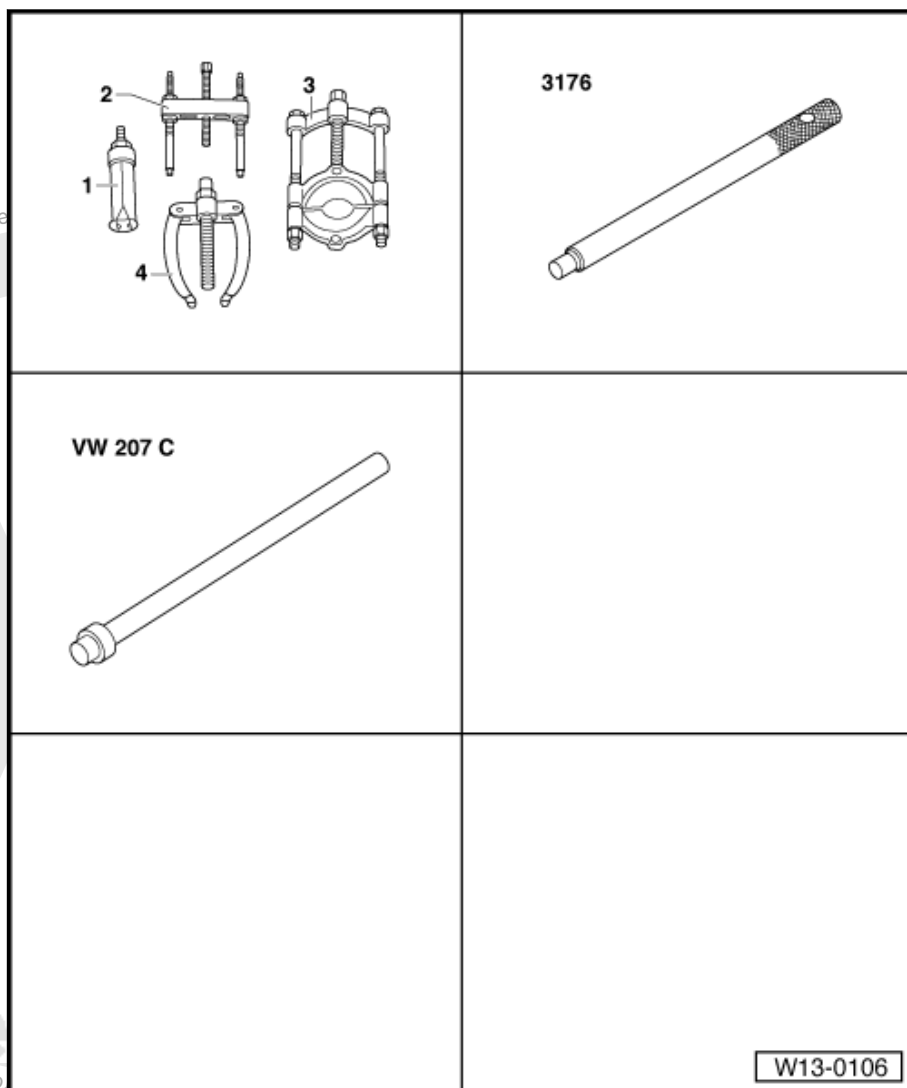
Special tools and workshop equipment required



- ◆ Engine Support Bridge -10-222A-
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13- (quantity: 2)
- ◆ Locking Pin -T10060A-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-



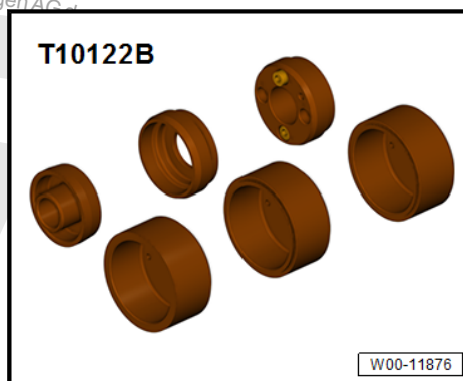
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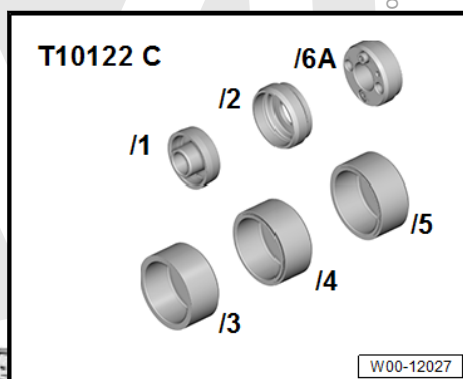
- ◆ -1- Puller - Kukko Internal - 14-19mm -21/2- and -4- Puller - Kukko Counterstay -22/1-
- ◆ Alignment Tool - Clutch Plate -3176-
- ◆ Bearing Installer - Bearing Press Piece -VW207C-
- ◆ -1- Puller - Kukko Internal - 14-19mm -21/2- and -4- Puller - Kukko Counterstay -22/1-
- ◆ Alignment Tool - Clutch Plate -3176-
- ◆ Bearing Installer - Bearing Press Piece -VW207C-



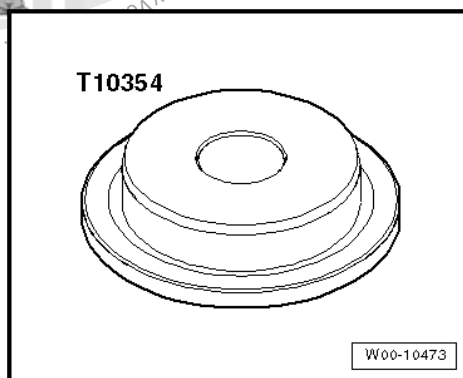
- ◆ Crank Shaft Seal Installer - Guide Piece -T10122/6- or -T10122/6A- from the Seal Installer - Crankshaft -T10122B- or -T10122C-



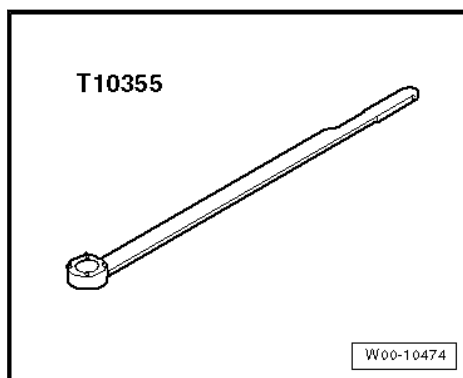
- ◆ Guide Piece to Crankshaft Seal Install Kit - Guide Piece -T10122/1- from the Seal Installer - Crankshaft -T10122B- or -T10122C-



- ◆ Seal Installer - Crankshaft -T10354-

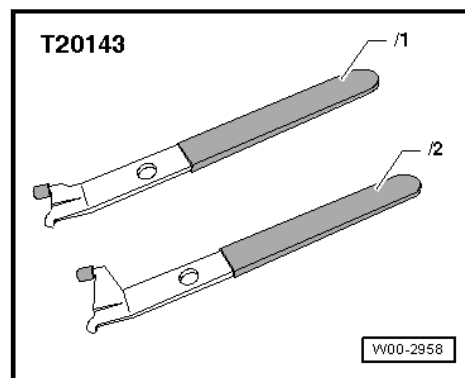


- ◆ Counterhold - Vibration Damper -T10355-

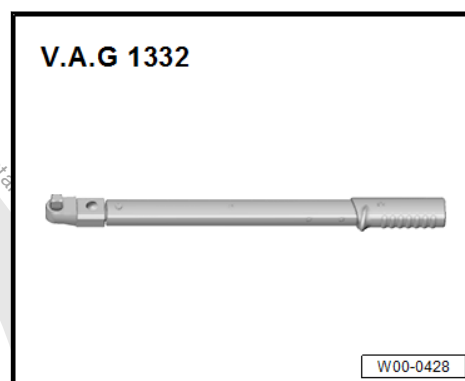




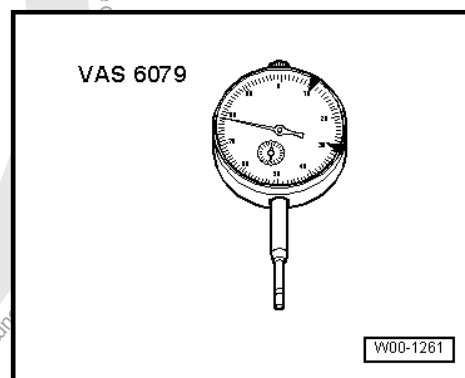
- ◆ Puller - Crankshaft/Power Steering Seal 2 -T20143/2-



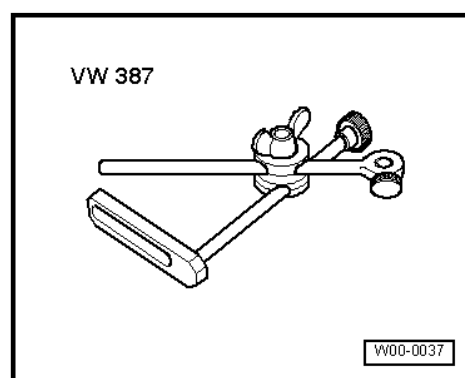
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-



- ◆ Dial Gauge - 0-10mm -VAS6079-

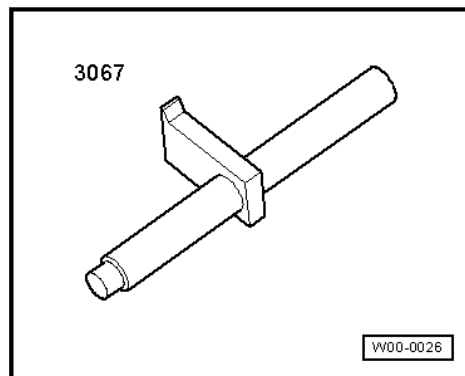


- ◆ Dial Gauge Holder VW387-





◆ Flywheel Retainer -3067-



◆ Press Piece - Timing Chain Cover -T10368-

◆ Seal Installer - Sealing Flange Guide Sleeve -T20097-



## 15 – Cylinder Head, Valvetrain

### 1 Description and Operation

⇒ -1.1 [Balance Shaft Drive Chain", page 93](#)

⇒ -1.2 [Camshaft Timing Chains", page 96](#)

⇒ -1.3 [Cylinder Head", page 98](#)

⇒ -1.4 [Timing Chain Cover", page 103](#)

⇒ -1.5 [Valvetrain", page 106](#)

#### 1.1 Overview - Balance Shaft Drive Chain





**1 - Bolt**

- ☐ 9 Nm

**2 - Balance Shaft**

- ☐ Replace after removing
- ☐ Exhaust side
- ☐ Lubricate the bearing with engine oil
- ☐ Removing and installing. Refer to ➤ [Fig. "Balance Shaft Pipe - Installed Position", page 95](#).

**3 - Pipe for the Balance Shaft**

- ☐ Note the installation position. Refer to ➤ [Fig. "Balance Shaft Pipe - Installed Position", page 95](#).

**4 - Chain Tensioner**

- ☐ 65 Nm
- ☐ Install with locking compound. Refer to the Parts Catalog.

**5 - Cylinder Block**

**6 - Balance Shaft**

- ☐ Replace after removing
- ☐ Intake side
- ☐ Lubricate the bearing with engine oil
- ☐ Removing and installing. Refer to ➤ [Fig. "Balance Shaft Pipe - Installed Position", page 95](#).

**7 - O-Ring**

- ☐ Always replace
- ☐ Lubricate with engine oil

**8 - Mounting Pin**

- ☐ Lubricate with engine oil
- ☐ Note the installation position. Refer to ➤ [Fig. "Mounting Pins - Installation Position", page 95](#).

**9 - Intermediate Shaft Sprocket**

- ☐ For the balance shaft
- ☐ The intermediate shaft sprocket must be replaced if the bolt is loosened.

**10 - Bolt**

- ☐ 9 Nm

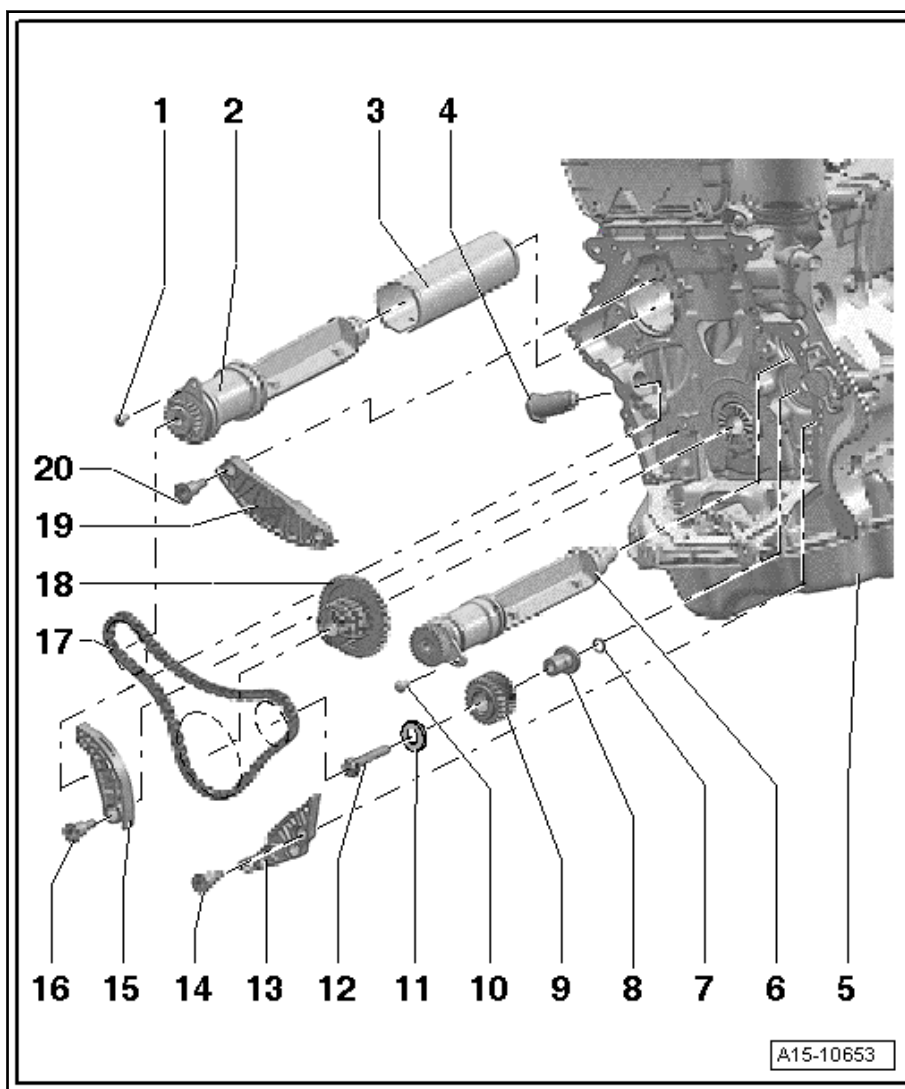
**11 - Washer**

**12 - Bolt**

- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Intermediate Shaft Sprocket - Tightening Sequence and Tightening Specification", page 95](#).
- ☐ Always replace
- ☐ The intermediate shaft sprocket must be replaced if the bolt is loosened.

**13 - Guide Rail**

- ☐ For the timing chain







#### 14 - Guide Pin

- ❑ 20 Nm

#### 15 - Tensioning Rail

- ❑ For the balance shaft timing chain

#### 16 - Guide Pin

- ❑ 20 Nm

#### 17 - Balance Shaft Timing Chain

- ❑ Removing and installing. Refer to ➔ [S3.1 haft Drive Chain", page 115](#) .

#### 18 - Chain Sprocket Crankshaft

- ❑ Note the installation position ➔ [Fig. ""Chain Sprocket Crankshaft, Installation Position"" , page 97](#) .

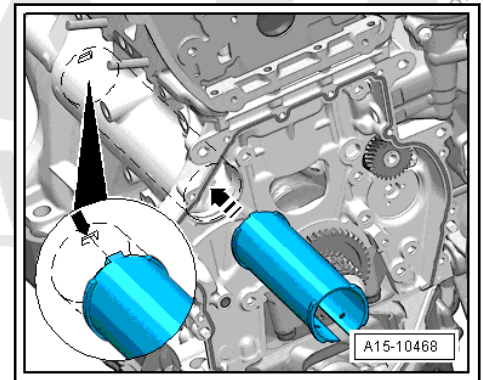
#### 19 - Guide Rail

- ❑ For the balance shaft timing chain

#### 20 - Guide Pin

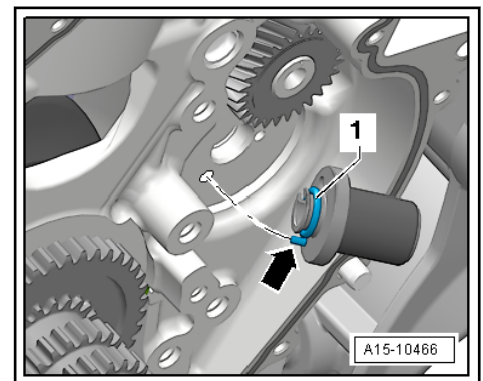
- ❑ 20 Nm

#### Balance Shaft Pipe - Installed Position



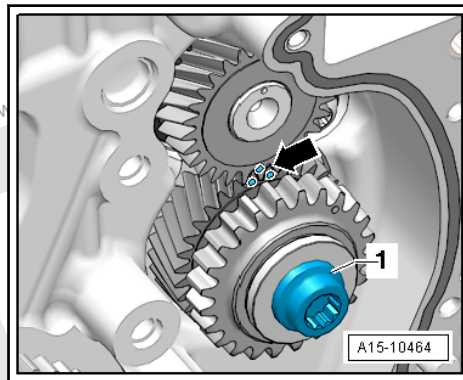
- The pin from the balance shaft pipe must fit into the groove in direction of -arrow-

#### Mounting Pins - Installation Position



- Replace and lubricate the O-ring -1-.
- The alignment pin -arrow- for the bearing pins must engage in the hole in the cylinder block.
- Lubricate the bearing pins

#### Intermediate Shaft Sprocket - Tightening Sequence and Tightening Specification



### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Procedure



#### Caution

***Always replace the intermediate shaft sprocket. Otherwise the backlash will not adjust itself and it could result in engine damage. The new intermediate shaft sprocket has an anti-friction coating that wears off after a short period of use, which automatically adjusts the backlash.***

- Tighten in four steps described below:
  1. Tighten the bolt to 10 Nm.
  2. Turn the chain sprocket.
  - Chain sprocket cannot have any play. If it does, loosen and tighten it back up.
  3. Tighten the bolt to 30 Nm.
  4. Continue tightening bolt using a TORX® key, 90° (1/4 turn).

## 1.2 Overview - Camshaft Timing Chains



**1 - Bolt**

- ☐ 9 Nm

**2 - Chain Tensioner**

- ☐ Is under tension
- ☐ Secure with the Locking Pin (3 pc.) -T40011- before removing

**3 - Timing Chain Tensioning Rail**

**4 - Guide Pin**

- ☐ 20 Nm

**5 - Bolt**

- ☐ 9 Nm

**6 - Control Valve**

- ☐ 35 Nm
- ☐ Left-hand thread
- ☐ Remove with the Central Valve Assembly Tool -T10352-

**7 - Bolt**

M 6 bolt

- ☐ 8 Nm + 1/4 (90°) additional turn

M8 Bolt:

- ☐ 20 Nm + 1/4 (90°) additional turn
- ☐ Always replace

**8 - Washer**

**9 - Bearing Bracket**

**10 - Camshaft Timing Chain Guide Rail**

**11 - Camshaft Housing**

**12 - Camshaft Timing Chain**

- ☐ Before removing, mark the direction of rotation with paint
- ☐ Removing and installing. Refer to [⇒ T3.4 iming Chain, Removing and Installing](#), page 128 .

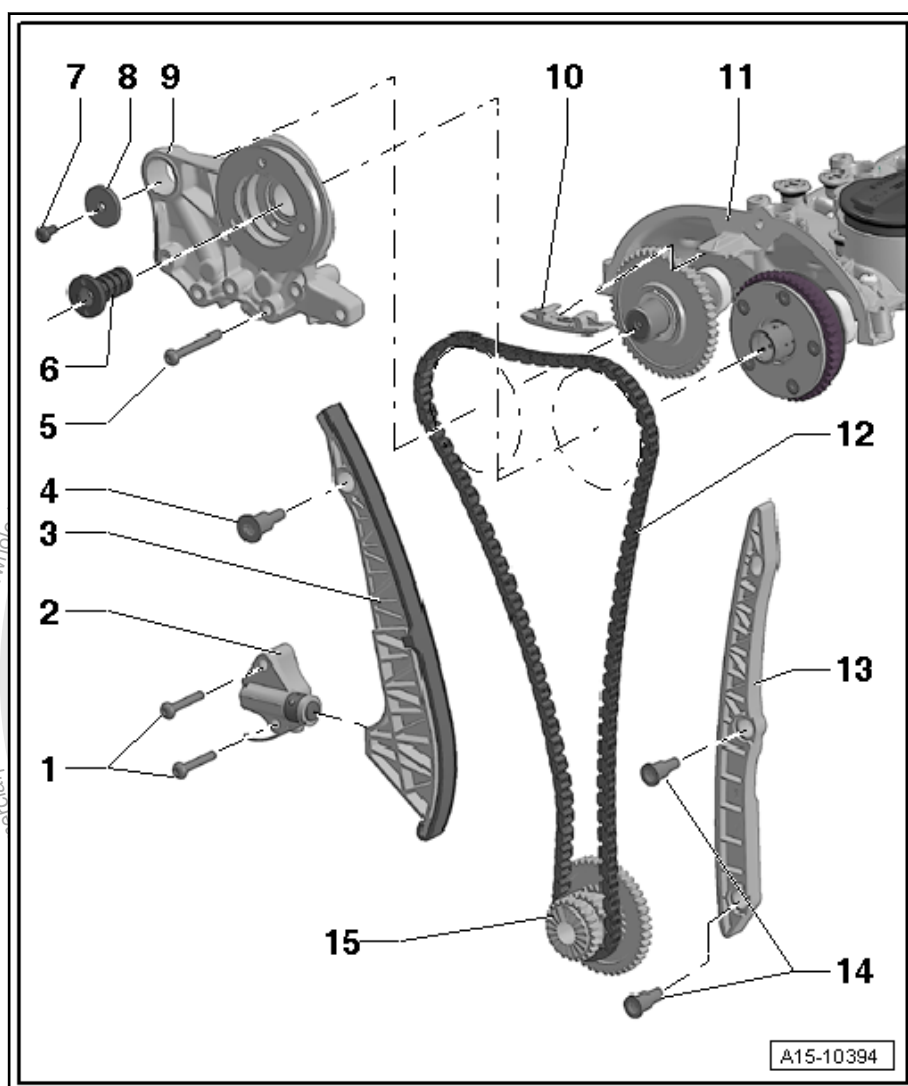
**13 - Camshaft Timing Chain Guide Rail**

**14 - Guide Pin**

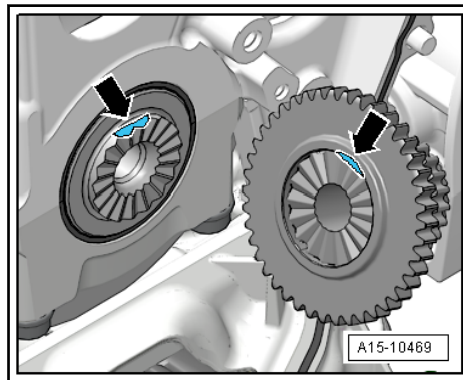
- ☐ 20 Nm

**15 - Chain Sprocket Crankshaft**

- ☐ Note the installation position. Refer to [⇒ Fig. ""Chain Sprocket Crankshaft, Installation Position""](#), page 97 .



**Chain Sprocket Crankshaft, Installation Position**



- Both surfaces -arrows- must align across from each other.

### 1.3 Overview - Cylinder Head



#### Note

- ◆ *Replace the cylinder head bolts.*
- ◆ *Always replace self-locking nuts, bolts which have been tightened an additional turn as well as gaskets and seals.*
- ◆ *The plastic protectors installed to protect the open valves must only be removed immediately before fitting the cylinder head.*
- ◆ *When replacing the cylinder head or cylinder head gasket, the coolant must be completely replaced.*



# 1 - Cylinder Head Seal

- ☐ Always replace
- ☐ Pay attention to the installation position: the part number must be visible from the intake side

# 2 - Bolt

- ☐ 25 Nm

# 3 - Transport Strap

# 4 - Bolt

- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Cylinder Head, Tightening Sequence and Tightening Specification", page 101](#).
- ☐ Always replace
- ☐ Follow the sequence when loosening. Refer to ➤ [Fig. "Loosen the Cylinder Head", page 101](#)

# 5 - Cylinder Head

- ☐ Check for distortion. Refer to ➤ [Fig. "Checking Cylinder Head for Distortion", page 102](#)
- ☐ Removing and installing. Refer to ➤ [H3.5 ead", page 144](#)
- ☐ Compression pressure, checking. Refer to ➤ [C2.2 hecking", page 110](#)

# 6 - Cylinder Head Bolt

- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Cylinder Head, Tightening Sequence and Tightening Specification", page 101](#).
- ☐ Always replace
- ☐ With a washer
- ☐ Follow the sequence when loosening. Refer to ➤ [Fig. "Loosen the Cylinder Head", page 101](#)

# 7 - O-Ring

- ☐ Always replace
- ☐ Lubricate with engine oil

# 8 - Plugs

- ☐ 5 Nm
- ☐ With ball head for the engine cover

# 9 - Cap

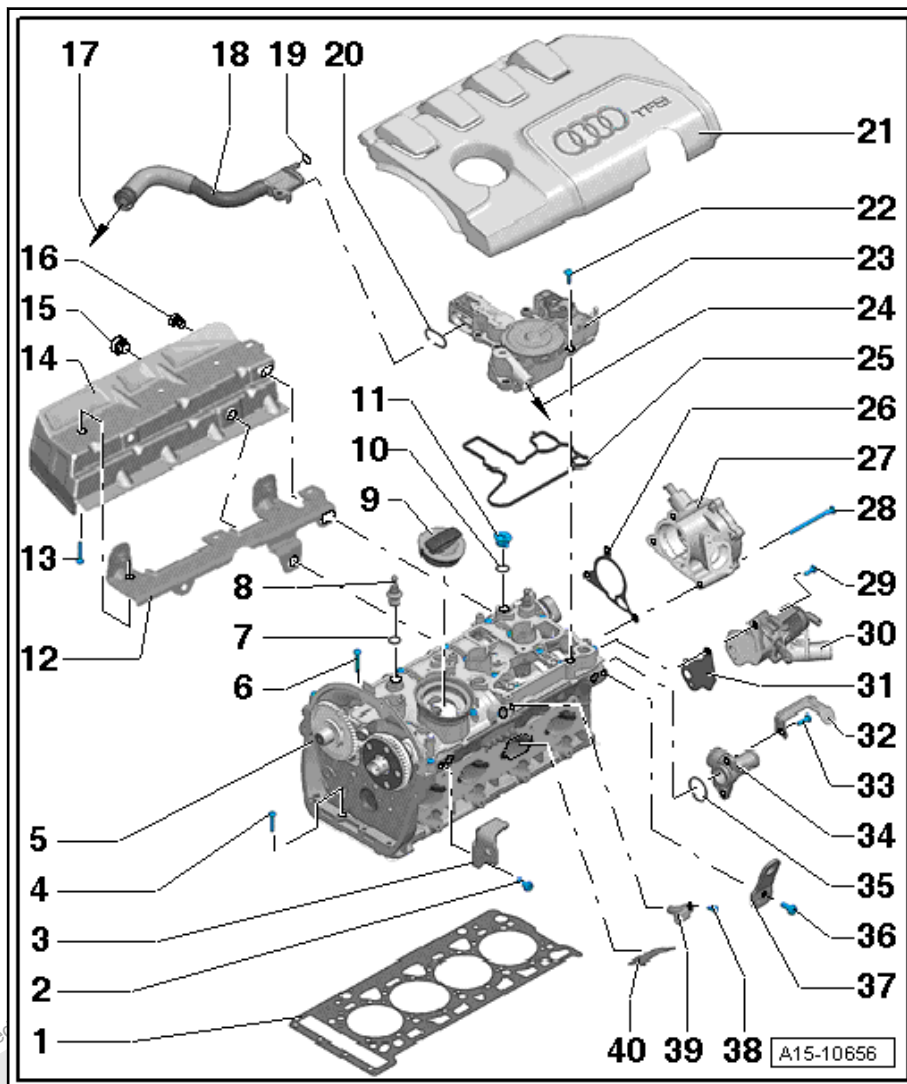
- ☐ With seal

# 10 - O-Ring

- ☐ No Replacement Part

# 11 - Plugs

- ☐ Always replace





- ☐ Oil the O-ring with engine oil

## 12 - Bracket

## 13 - Bolt

- ☐ 9 Nm

## 14 - Heat Shield

## 15 - Bolt

- ☐ 20 Nm

## 16 - Bolt

- ☐ 20 Nm

## 17 - To Intake Manifold/Turbocharger

## 18 - Bleed Pipe

## 19 - O-Ring

- ☐ No Replacement Part

## 20 - Seal

- ☐ No Replacement Part

## 21 - Engine Cover

## 22 - Bolt

- ☐ Tightening sequence. Refer to ➔ [Fig. "Crankcase Ventilation, Tightening Sequence and Tightening Specification", page 101](#)

## 23 - Crankcase Ventilation

- ☐ Observe sequence for tightening. Refer to ➔ [Fig. "Crankcase Ventilation, Tightening Sequence and Tightening Specification", page 101](#)

## 24 - To Intake Manifold

## 25 - Seal

- ☐ No Replacement Part

## 26 - Seal

- ☐ Replace if damaged

## 27 - Vacuum Pump

- ☐ Removing and installing

## 28 - Vacuum Pump Bolts M 6 x 70

- ☐ 9 Nm

## 29 - Bolt

- ☐ 9 Nm
- ☐ Engine code CBFA only

## 30 - Secondary Air Injection Solenoid Valve -N112-

- ☐ Engine code CBFA only

## 31 - Seal

- ☐ Always replace
- ☐ Engine code CBFA only

## 32 - Retaining Plate

## 33 - Bolt

- ☐ 9 Nm

## 34 - Connection

## 35 - O-Ring

- ☐ Always replace





- ☐ Coat with coolant

### 36 - Bolt

- ☐ 25 Nm

### 37 - Transport Strap

### 38 - Bolt

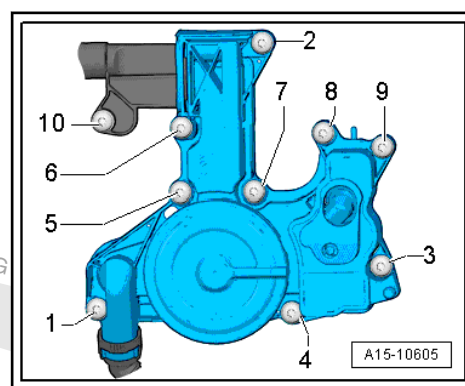
- ☐ 9 Nm

### 39 - Camshaft Position Sensor -G40-

- ☐ With O-ring
- ☐ Lubricate the O-ring with engine oil before installing

### 40 - Partition Plate

## Crankcase Ventilation, Tightening Sequence and Tightening Specification



### Special tools and workshop equipment required

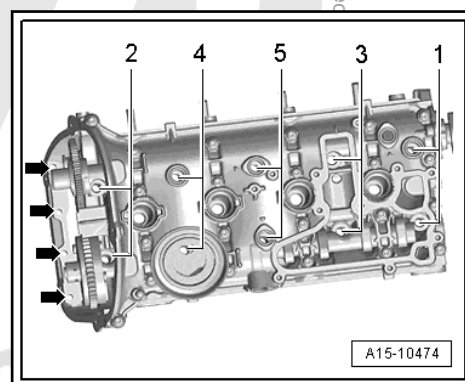
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Procedure

- Tighten the crankcase ventilation bolts in the sequence -1 to 10-.

Tightening specification: 11 Nm

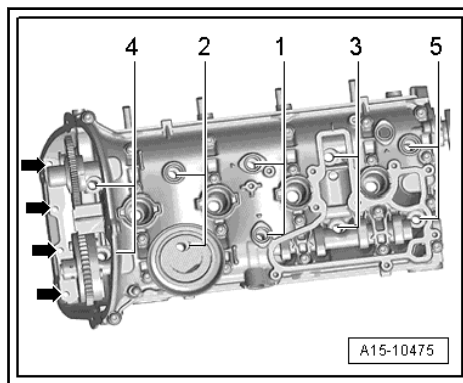
### Loosen the Cylinder Head



- Remove the bolts -arrows-.
- Loosen the cylinder head bolts in the sequence -1 to 5-.

## Cylinder Head, Tightening Sequence and Tightening Specification





### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Procedure

- Tighten the new cylinder head bolts in 3 stages in -1 to 5- sequence as follows:
  1. Pre-tighten the bolts to 40 Nm.
  2. With TORX® key, 90° (1/4 turn) additional turn.
  3. With TORX® key, 90° (1/4 turn) additional turn.

Then:

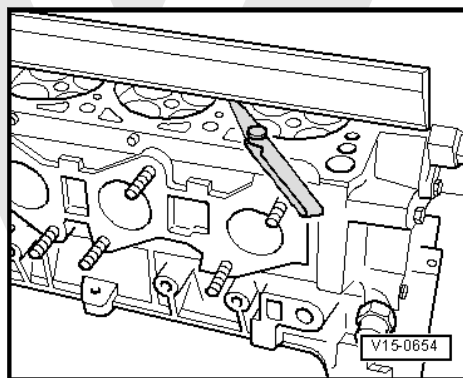
- Tighten the new bolts -arrows- to 8 Nm.
- Tighten bolts -arrows- with a TORX® key 90° (1/4 additional turn).



### Note

*It is not necessary to retighten the cylinder head bolts after repairs.*

### Checking Cylinder Head for Distortion



### Special tools and workshop equipment required

- ◆ Straight Edge - 500mm -VAS6075-
- ◆ Feeler Gauge

### Procedure

- Check the cylinder head at several locations for distortion using a Straight Edge - 500mm -VAS6075- and a feeler gauge.



- Maximum permissible distortion: 0.05 mm

## 1.4 Overview - Timing Chain Cover





**1 - O-Ring**

- ☐ Always replace
- ☐ Coat with oil before assembly

**2 - Oil Dipstick Tube**

**3 - Bolt**

- ☐ 9 Nm

**4 - Bolt**

- ☐ 9 Nm

**5 - Camshaft Adjustment Valve 1-N205-**

- ☐ Removing and installing. Refer to [⇒ C3.3 camshaft Adjustment Valve 1 N205](#), page 127.

**6 - Gasket**

- ☐ Replace if damaged
- ☐ Coat with oil before assembly

**7 - Bolt**

- ☐ Tightening sequence and specification. Refer to [⇒ Fig. "Upper Timing Chain Cover - Tightening Sequence and Tightening Specification"](#), page 105.

**8 - Upper Timing Chain Cover**

- ☐ Tightening sequence. Refer to [⇒ Fig. "Upper Timing Chain Cover - Tightening Sequence and Tightening Specification"](#), page 105
- ☐ Removing and installing. Refer to [⇒ T3.9 Timing Chain Cover](#), page 176.

**9 - Seal**

- ☐ Replace if damaged

**10 - O-Ring**

- ☐ Always replace
- ☐ Coat with oil before assembly

**11 - Alignment Pins**

- ☐ Centering the cover

**12 - Lower Timing Chain Cover**

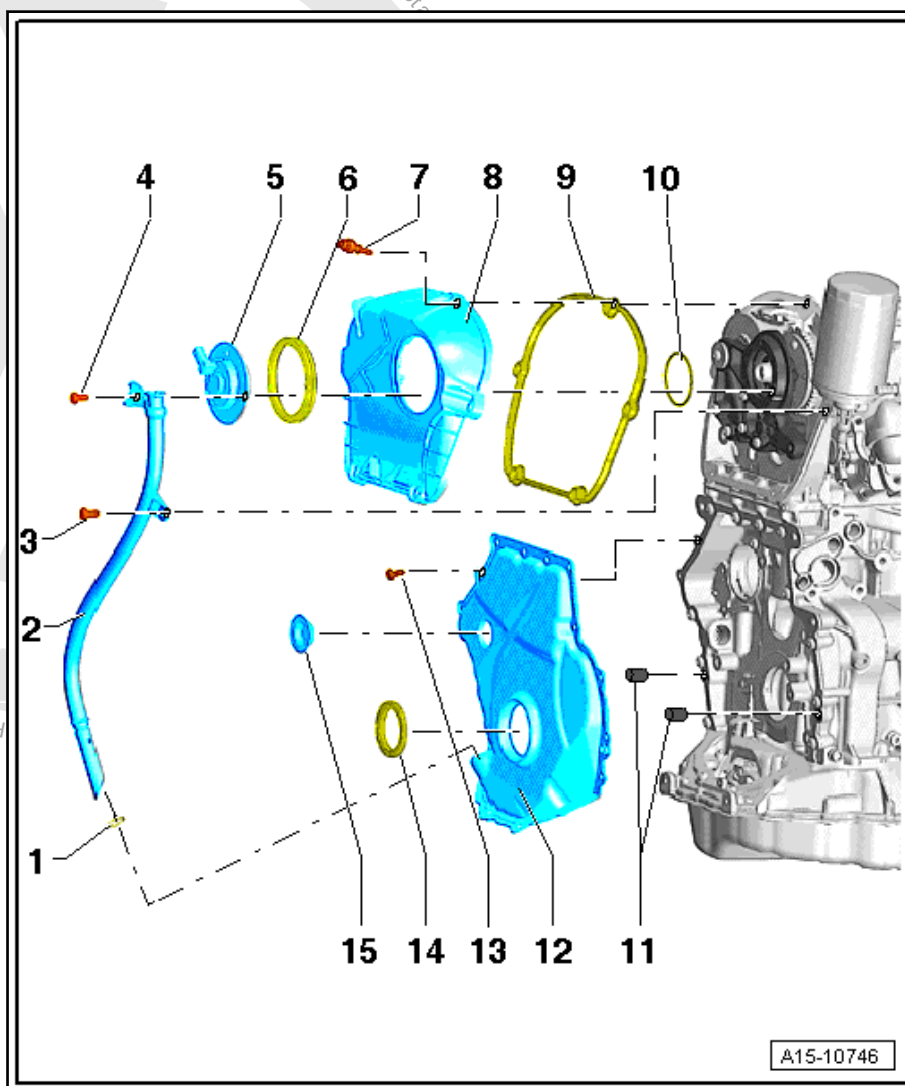
- ☐ Removing and installing. Refer to [⇒ T3.8 Timing Chain Cover](#), page 169.

**13 - Bolt**

- ☐ Tightening sequence and specification. Refer to [⇒ Fig. "Lower Timing Chain Cover - Tightening Specifications and Tightening Sequence"](#), page 105.
- ☐ Always replace

**14 - Gasket**

- ☐ For the vibration damper
- ☐ Replacing. Refer to [⇒ D5.10 Camper Sealing Ring, Replacing](#), page 85.

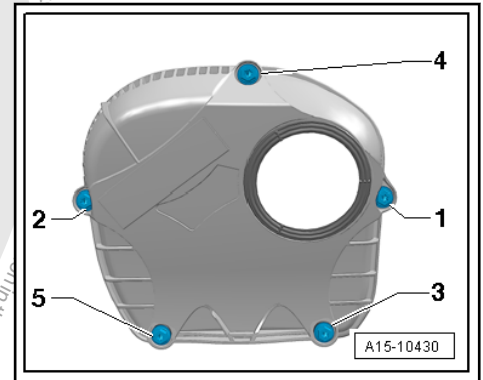




## 15 - Plugs

- ☒ Always replace

### Upper Timing Chain Cover - Tightening Sequence and Tightening Specification



### Special tools and workshop equipment required

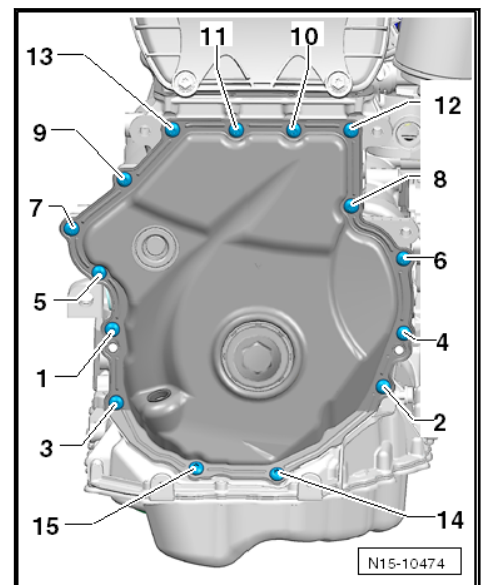
- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Torque Wrench 1783 - Open Jaw - 10mm -VAG1783/1-

### Procedure

- Tighten bolts in 2 stages in -1 to 5- sequence as follows:

1. Tighten bolts hand-tight.
2. Tighten the bolts to 9 Nm.

### Lower Timing Chain Cover - Tightening Specifications and Tightening Sequence



### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Procedure

- Tighten the new bolts in the sequence -1 through 15- and in the following three steps:

1. Tighten bolts hand-tight.



2. Tighten the bolts to 8 Nm.
3. Turn the bolts 45° (1/8 turn) additional turn.

## 1.5 Overview - Valvetrain





## 1 - Exhaust Valve

- ☐ Do not rework, only lapping is permitted
- ☐ Valve dimensions. Refer to ➤ [Fig. "Valve Dimensions", page 108](#).
- ☐ Valve guides, checking. Refer to ➤ [G2.3 uides, Checking", page 111](#).

## 2 - Cylinder Head

## 3 - Valve Guide

- ☐ Checking. Refer to ➤ [G2.3 uides, Checking", page 111](#).

## 4 - Valve Stem Seal

- ☐ Replacing. Refer to ➤ [S3.11 tem Seals", page 179](#).

## 5 - Valve Spring

## 6 - Valve Spring Retainer

## 7 - Valve Retainers

## 8 - Hydraulic Adjusting Element

- ☐ Do not interchange
- ☐ Lubricate contact surfaces

## 9 - Exhaust Camshaft

- ☐ Removing and installing. Refer to ➤ [3.2, page 118](#).
- ☐ Axial play, checking. Refer to ➤ [M2.1 easuring Axial Clearance", page 110](#).
- ☐ Check radial clearance using Plastigauge® (roller rocker lever removed)
- ☐ Radial clearance with 24 mm bearing diameter: 0.024 to 0.066 mm
- ☐ Radial clearance on 32 mm bearing diameter: 0.030 to 0.051 mm
- ☐ Run-out: maximum 0.04 mm

## 10 - Cylinder Head Cover

- ☐ With integrated camshaft bearings
- ☐ Clean sealing surface, reworking is not permitted.
- ☐ Remove old sealant residue.

## 11 - Bolt

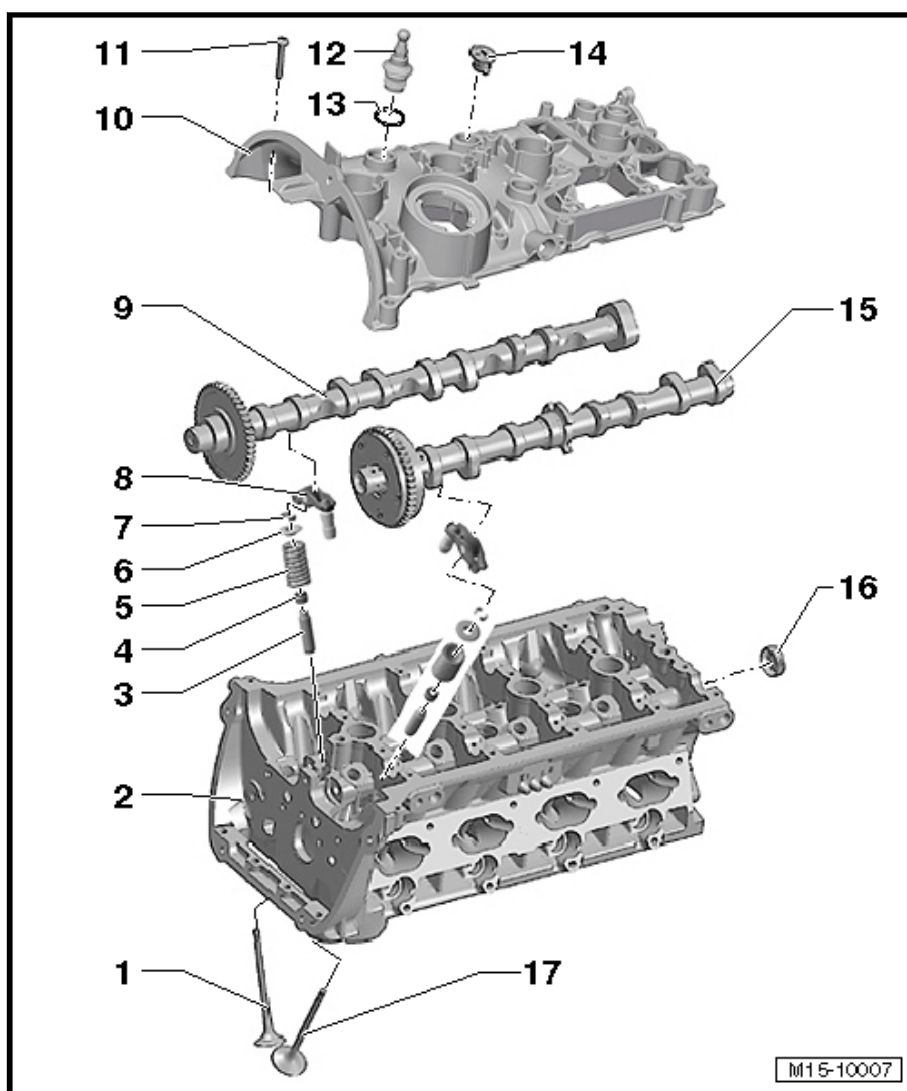
- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Cylinder Head Cover, Tightening Sequence and Tightening Specification", page 108](#).
- ☐ Always replace

## 12 - Plugs

- ☐ 5 Nm
- ☐ With ball head for the engine cover

## 13 - O-Ring

- ☐ Always replace
- ☐ Lubricate with engine oil





#### 14 - Sealing Plug with O-ring

- ☐ Always replace
- ☐ Oil the O-ring with engine oil

#### 15 - Intake Camshaft

- ☐ Removing and installing. Refer to ➤ [3.2, page 118](#).
- ☐ Axial play, checking. Refer to ➤ [M2.1 easuring Axial Clearance", page 110](#).
- ☐ Check radial clearance using Plastigauge® (roller rocker lever removed)
- ☐ Radial clearance with 24 mm bearing diameter: 0.024 to 0.066 mm
- ☐ Run-out: maximum 0.04 mm

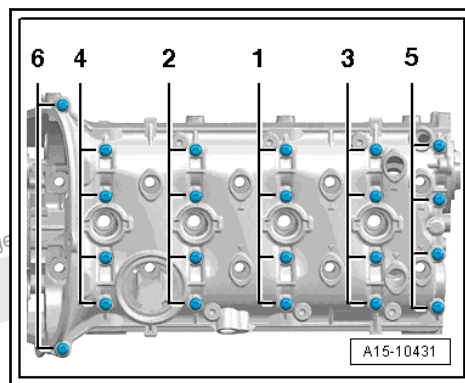
#### 16 - Cap

- ☐ Always replace
- ☐ Removing: with the cylinder head cover installed, pierce through one side of the cover with an awl and pry it out
- ☐ Installing: without sealant, press in 1 to 2 mm using the Seal Installer - Selector Shaft Oil Seal -T10174-

#### 17 - Intake Valve

- ☐ Do not rework, only lapping is permitted
- ☐ Valve dimensions. Refer to ➤ [Fig. "Valve Dimensions", page 108](#).
- ☐ Valve guides, checking. Refer to ➤ [G2.3 uides, Checking", page 111](#).

### Cylinder Head Cover, Tightening Sequence and Tightening Specification



#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

#### Procedure

- Tighten the new cylinder head cover bolts in 3 stages in -1 to 6- sequence as follows:
  1. Tighten bolts hand-tight.
  2. Tighten the bolts to 8 Nm.
  3. Turn the bolts an additional 90° (1/4 turn).

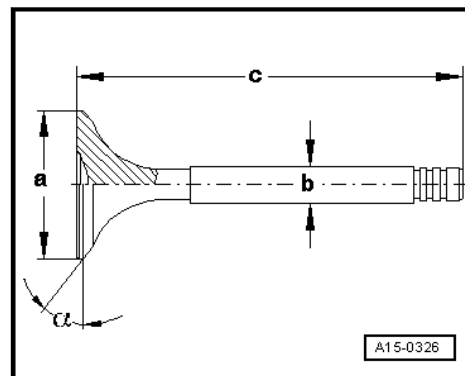


#### Note

Ensure that the guide frame is not tilted.

#### Valve Dimensions





# **Note**

*Intake and exhaust valves must not be reworked. Only lapping is permitted.*

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	$33.85 \pm 0.10$	$28.00 \pm 0.1$
Diameter b	mm	$5.980 \pm 0.007$	$5.955 \pm 0.007$
c	mm	103.97	101.87
α	°	45	45



## 2 Diagnosis and Testing

⇒ M2.1 Measuring Axial Clearance, page 110

⇒ C2.2 Checking, page 110

⇒ G2.3 Guides, Checking, page 111

⇒ T2.4 Timing, Checking, page 112

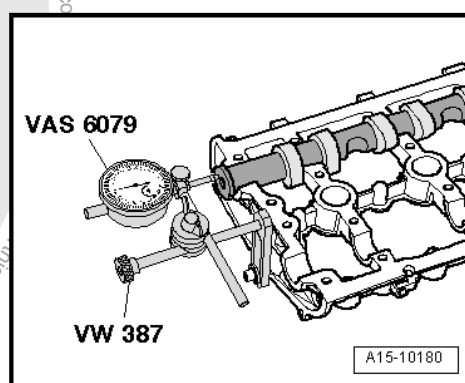
### 2.1 Camshaft, Measuring Axial Clearance

#### Special tools and workshop equipment required

- ◆ Dial Gauge Holder -VW387-
- ◆ Dial Gauge - 0-10mm -VAS6079-

#### Test Sequence

- Perform the test with guide frame removed.
- Place camshaft to be checked in guide frame.
- Secure the Dial Gauge - 0-10mm -VAS6079- with the Dial Gauge Holder -VW387- on the cylinder head.
- Press the camshaft against the Dial Gauge - 0-10mm -VAS6079- by hand.
- Set the Dial Gauge - 0-10mm -VAS6079- to "0".
- Push the camshaft off the Dial Gauge - 0-10mm -VAS6079- and read the value:
  - Axial play: 0.05 to 0.17 mm.



### 2.2 Compression, Checking

#### Special tools and workshop equipment required

- ◆ Spark Plug Removal Tool -3122B-
- ◆ Puller - Ignition Coil -T40039-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Compression Tester Kit -VAG1763- with Compression Tester Kit - Adapter 6 -VAG1763/6-

#### Test Conditions

- The engine oil temperature must be at least 30 °C (86 °F).
- Battery voltage at least 12.7 V



## Test Sequence



### Note

Follow all safety precautions. Refer to [⇒ P1.1 recautions", page 453](#).

- Remove the Ignition Coil with Power Output Stage. Refer to [⇒ C4.2 oils with Power Output Stages", page 459](#).
- Remove the Spark Plugs using the Spark Plug Removal Tool -3122B-.
- Check the compression pressure using the Compression Tester Kit -VAG1763- and Compression Tester Kit - Adapter 6 -VAG1763/6-.



### Note

Refer to the *Operating Instructions* for information on using the tester.

- Operate the starter until no further pressure increases are indicated by the Tester.

## Compression Values

- New: 11 to 14 bar (160 to 203 psi) pressure
- Wear limit: 7 bar (101.52 psi) pressure
- Permissible difference between all cylinders: maximum 3 bar (43 psi)
- Install the Spark Plugs. Refer to [⇒ -2.1 Ignition System", page 454](#).
- Install the Ignition Coil with Power Output Stage. Refer to [⇒ C4.2 oils with Power Output Stages", page 459](#).



### Note

By separating the connections, Diagnostic Trouble Codes (DTCs) will be stored. After the test, check the fault memory and erase, if necessary.

- Check the Engine Control Module DTC memory and erase any entries using Vehicle Diagnostic Tester in "Guided Function".



### Note

If the DTC memory was erased, the readiness code must be re-generated using the Vehicle Diagnostic Tester in "Guided Fault Finding" function.

## 2.3 Valve Guides, Checking

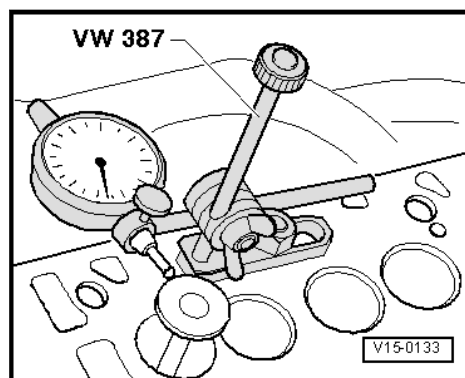
### Special tools and workshop equipment required

- ◆ Dial Gauge Holder -VW387-
- ◆ Dial Gauge - 0-10mm -VAS6079-





## Test Sequence



- Insert the valve into guide. The valve stem end must be flush with the guide. Use only the intake valve in the intake guide and the exhaust valve in the exhaust guide.
- Determine tilt clearance:
  - Intake and exhaust valve wear limit: 0.8 mm



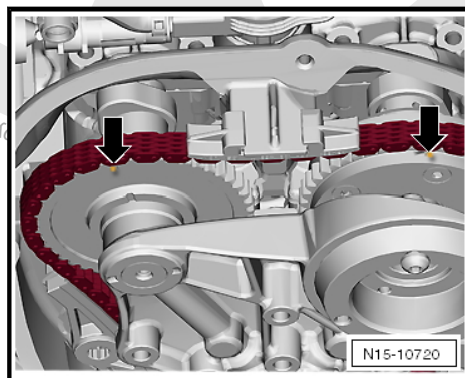
### Note

- ♦ If the wear limit is exceeded, measure again using new valves. If the wear limit is still exceeded, replace the cylinder head.
- ♦ If the valve is to be replaced as part of a repair, use a new valve for the measurement.

## 2.4 Valve Timing, Checking

### Special tools and workshop equipment required

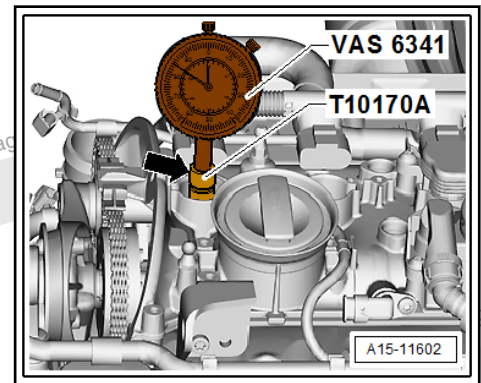
- ♦ Dial Gauge Adapter -T10170/A-
- ♦ Dial Gauge Set -VAS6341-
- Remove the upper timing chain cover. Refer to ➔ [T3.9 Timing Chain Cover](#), page 176 .
- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the right charge air hose at the coupling.
- Turn the crankshaft with the 24 mm socket on the vibration damper in the direction of the engine rotation until the markings -arrows- are almost on top.



- Remove the spark plug from cylinder 1.



- Install the Dial Gauge Adapter -T10170/A- all the way into the spark plug thread.

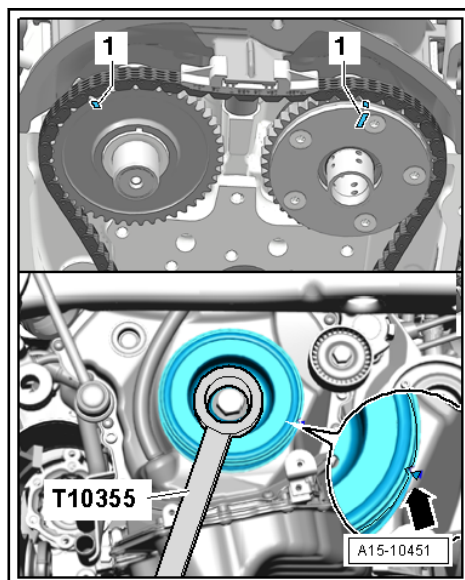


- Insert the Dial Indicator Set -VAS6341- using the Extension -T10170A/1- all the way and secure with the locking nut -arrow-.
- Turn the crankshaft slowly in the direction of engine rotation until the maximum dial reading is reached. When the maximum dial reading is reached (BDC of the meter), position the piston at »TDC«.

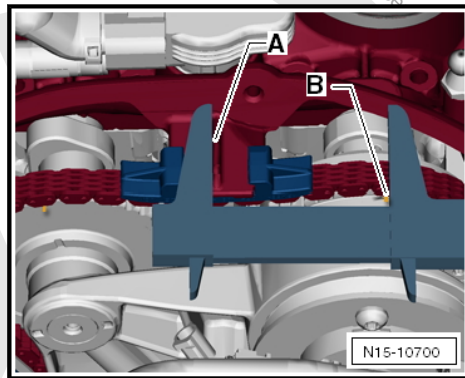


#### Note

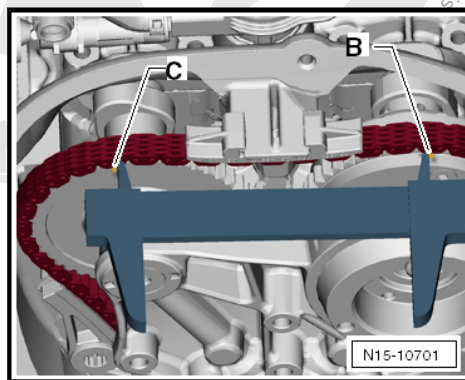
- ◆ Use a ratchet with a 24 mm socket to turn the vibration damper.
- ◆ If the crankshaft was turned past "TDC", turn the crankshaft two more turns in the direction of engine rotation. Do not turn the engine in the opposite direction of the engine rotation.
- The notch on the vibration damper must line up with the arrow marking on the lower timing chain cover -arrow- (use a mirror).



- The markings -1- on the camshafts must point upward.
- Measure the distance from the outer edge -A- to the marking -B- on the intake camshaft.



- Specified value: 61 to 64 mm.
- Once the specified value is reached, measure the distance between the marking on the intake camshaft -B- and the marking on the exhaust camshaft -C-.



- Specified value: 124 to 126 mm.



#### Note

*If one tooth is offset, there will be a deviation of approximately 6 mm from the specified value. The timing chain must be installed again if an offset is detected.*



### 3 Removal and Installation

- ⇒ [S3.1 haft Drive Chain", page 115](#)
- ⇒ [3.2 , page 118](#)
- ⇒ [C3.3 amshaft Adjustment Valve 1 N205 ", page 127](#)
- ⇒ [T3.4 iming Chain, Removing and Installing", page 128](#)
- ⇒ [H3.5 ead", page 144](#)
- ⇒ [C3.6 amshaft Balance Shaft", page 163](#)
- ⇒ [C3.7 amshaft Balance Shaft", page 166](#)
- ⇒ [T3.8 iming Chain Cover", page 169](#)
- ⇒ [T3.9 iming Chain Cover", page 176](#)
- ⇒ [P3.10 ump", page 178](#)
- ⇒ [S3.11 tem Seals", page 179](#)

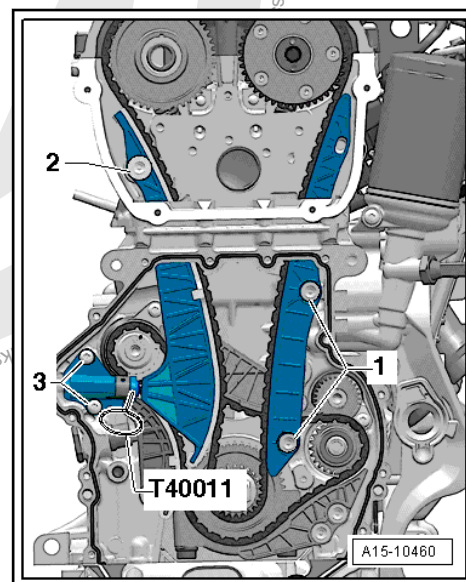
#### 3.1 Balance Shaft Drive Chain

##### Special tools and workshop equipment required

- ◆ Locking Pin (3 pc.) -T40011-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

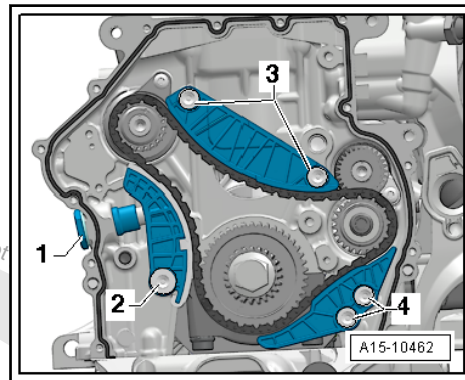
##### Removing

- Remove the camshaft timing chain. Refer to ⇒ [T3.4 iming Chain, Removing and Installing", page 128](#) .
- Remove the guide rail for the camshaft timing chain -1-.



- Remove the camshaft timing chain tensioner -3-.
- Remove the balance shaft chain tensioner -1-.

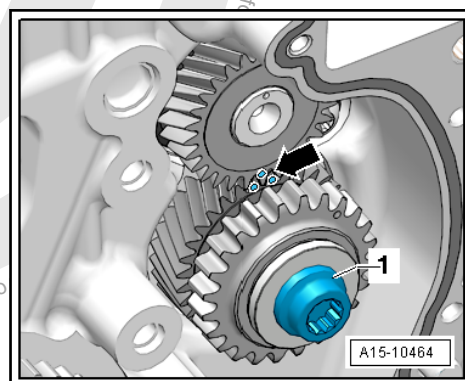




- Remove the tensioning rail -2-.
- Remove the guide rail -3-.
- Remove the guide rail -4-.
- Remove the timing chain.

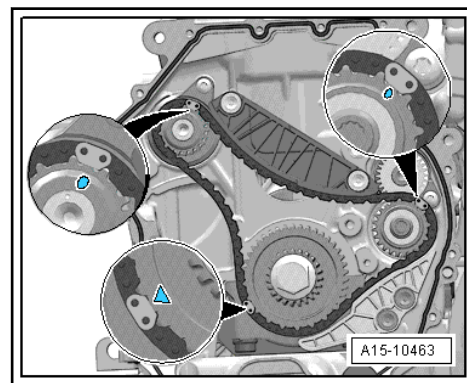
#### Installing

- Tightening specifications. Refer to ➤ [-1.1 Balance Shaft Drive Chain](#) [page 93](#) .
- Turn the intermediate shaft sprocket/balance shaft to the marking -arrow-.

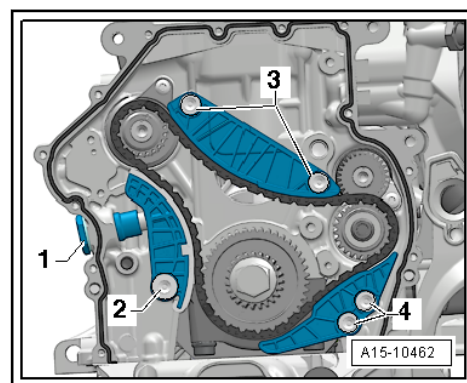


#### Note

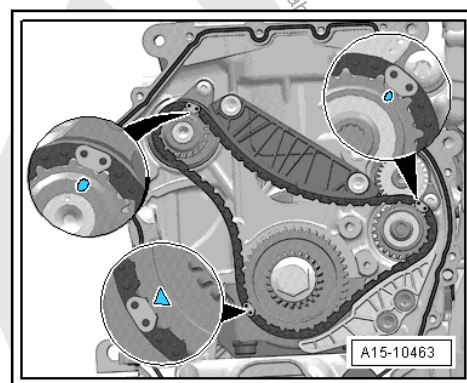
- ♦ *The painted links of the timing chain must be positioned on the markings on the chain sprockets.*
- ♦ *Due to the ratio, the markings only align after every 7th turn.*
- Mount the timing chain; the painted links of the timing chain must be positioned on the markings on the chain sprockets.



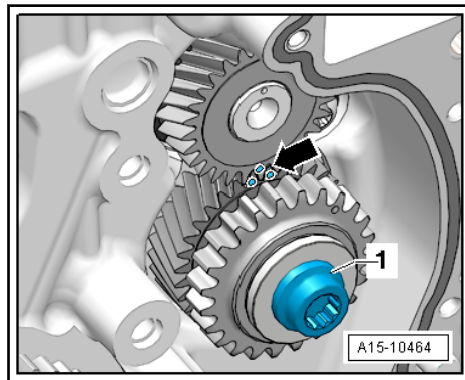
- Install the timing chain tensioning rail and tighten the bolt -2-.



- Install the timing chain guide rail and tighten the bolts -4-.
- Install the timing chain guide rail and tighten the bolts -3-.
- Install the timing chain tensioner -1- with locking compound. Refer to the Parts Catalog.
- Check this adjustment again.



- Check the markings on the intermediate shaft sprocket/balance shaft -arrow-.



#### Note

*The marking on the intermediate shaft sprocket/balance shaft is shown with the chain removed.*

Further assembly is performed the reverse order of the removal.

## 3.2 Camshaft

### Special tools and workshop equipment required

- ◆ Seal Installer - Selector Shaft Oil Seal -T10174-
- ◆ Central Valve Assembly Tool -T10352-
- ◆ Counterhold - Vibration Damper -T10355-
- ◆ Locking Pin (3 pc.) -T40011-
- ◆ Puller - Ignition Coil -T40039-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Silicone Sealant -D 154 103 A1-
- ◆ Cable Tie
- ◆ Flat scraper
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear



#### Note

- ◆ *The cylinder head and the cylinder head cover must be re-placed together.*
- ◆ *Do not start the engine for approximately 30 minutes after installing the camshafts. The hydraulic adjusting elements must seat themselves (otherwise the valves will seat themselves on the pistons).*
- ◆ *After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least two full revolutions to be sure that valves do not strike the pistons when starting.*
- ◆ *Always replace the gaskets and seals.*



## Removing



### Note

- ◆ *The sealing surfaces of the lower cylinder head cover and on the upper cylinder head must not be reworked.*
- ◆ *The camshaft bearings are integrated in the cylinder head or cylinder head cover. The tension must be released from the camshaft timing chain before removing the cylinder head cover.*
- ◆ *If the cylinder head cover was removed, the cap must be replaced.*
- ◆ *All cable ties which are opened or cut open when removing, must be replaced in the same position when installing.*

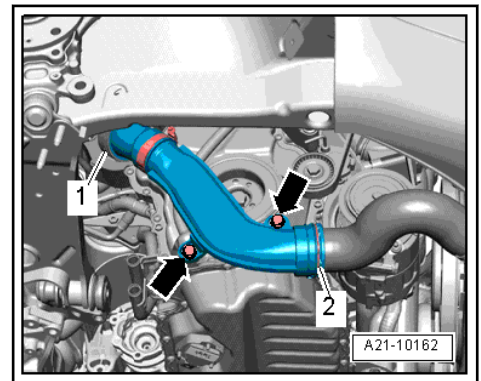


### Caution

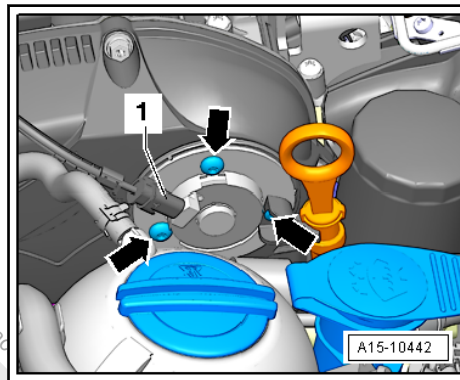
**When doing any assembly work, especially in the engine compartment, pay attention to the following due to the limited space.**

- ◆ *Route lines of all types (for example . for fuel, hydraulic, Evaporative Emission (EVAP) canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.*

- Remove the engine cover. Refer to [⇒ C3.1 over](#), [page 17](#).
- Remove the vacuum pump. Refer to [⇒ P3.10 ump](#), [page 178](#).
- Remove the noise insulation. Refer to [⇒ Body Exterior; Rep. Gr. 50; Description and Operation](#).
- Remove right front wheel.
- Remove the front section of the wheel housing liner or remove the front wheel housing liner. Refer to [⇒ Body Exterior; Rep. Gr. 66; Removal and Installation](#).
- Remove the bolts -arrows-.



- Remove the air guide pipe by lifting the clamps -1 and 2-.
- Disconnect the connector from the Camshaft Adjustment Valve 1 -N205- -1-.



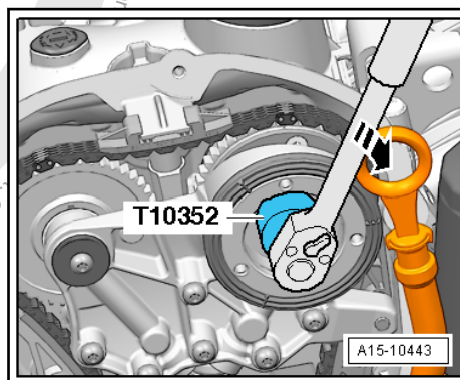
- Remove the bolts -arrows- and then remove the Camshaft Adjustment Valve 1 -N205-.
- Remove the upper timing chain cover. Refer to ➤ [T3.9 Timing Chain Cover](#), page 176 .



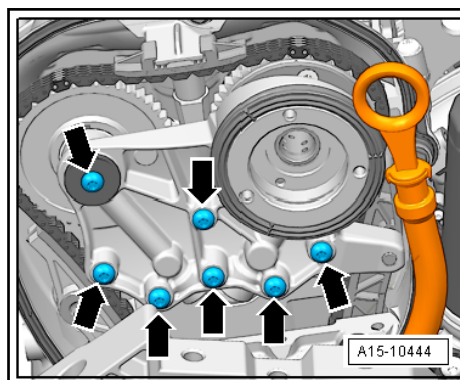
**Caution**

*The control valve has left-hand thread.*

- Remove the control valve in direction of -arrow- using the Central Valve Assembly Tool -T10352-.

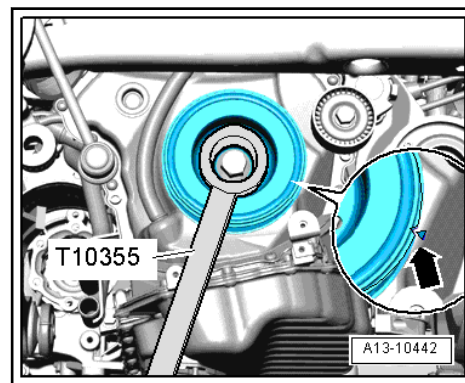


- Remove the bolts -arrows- and remove the bearing bracket.

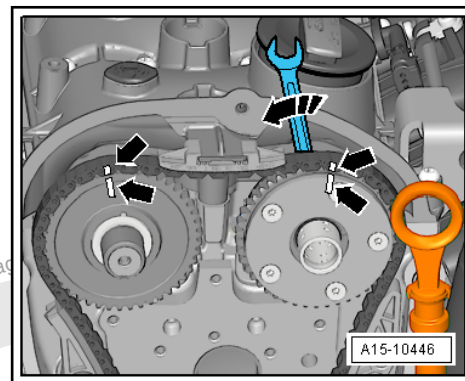


- Turn the vibration damper into “Top Dead Center (TDC)” -arrow- using the Counterhold - Vibration Damper - T10355A-.

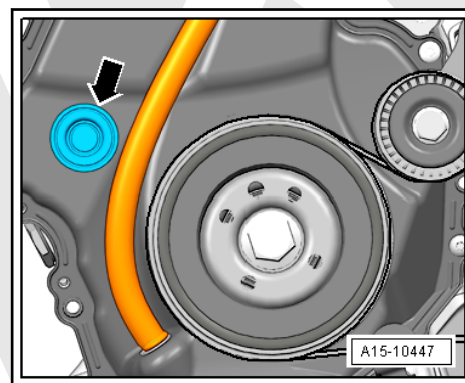




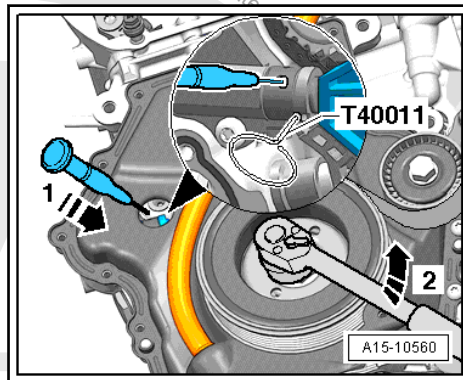
- The notch on the vibration damper must align with the arrow marking on the lower timing chain cover.
- Carefully mark the drive chain/chain sprockets -arrows- with a waterproof marker. These marks are necessary for reinstallation.



- Remove the plug -arrow-.



- Lift the chain tensioner locking wedge by inserting a scribe or a suitable screwdriver into the hole in the chain tensioner in direction of -arrow 1-.



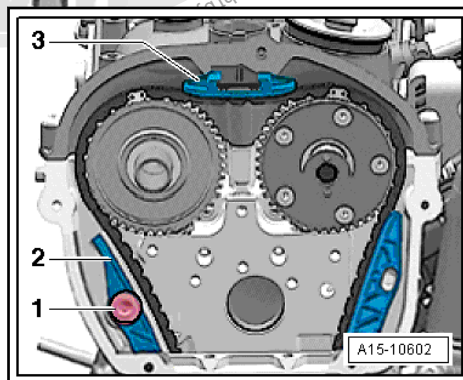
- Turn the crankshaft in the opposite direction of engine rotation -arrow 2- and secure it with Locking Pin (3 pc.) -T40011-.



#### Note

*The intake camshaft switches in the engine direction of rotation.*

- Remove the bolt -1- and guide the tensioning rail -2- downward.



- Remove the upper guide track -3- by unlocking the latch with a screwdriver and pushing the guide track forward.



#### Note

*When the lower timing chain cover is installed, the loose chain on the crankshaft can »not« jump off.*

- Remove camshaft timing chain from chain sprockets.



#### Caution

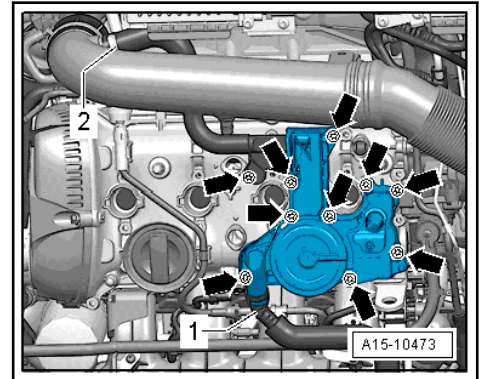
***Danger of damaging the valves, piston crowns and lower timing chain cover.***

- ♦ *If the camshaft timing chain was removed from the cylinder head, then the crankshaft may not be turned farther.*
- ♦ *Panels are installed on the lower timing chain cover to prevent the chain from falling down. The panels can bend if the crankshaft is rotated when the chain is loose.*

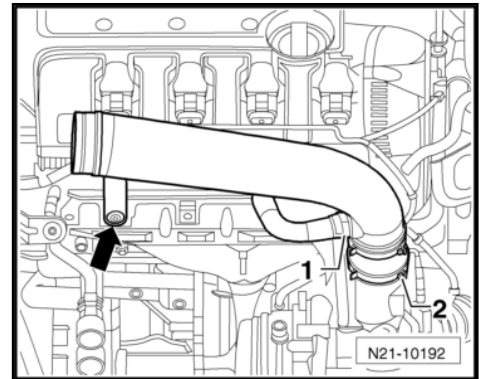




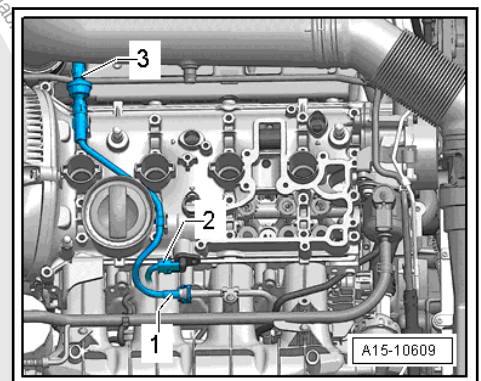
- Remove the Ignition Coils with Output Stages. Refer to [C4.2 oils with Power Output Stages](#), page 459, and lay the wiring harness to the side.
- Disconnect the crankcase ventilation hose -1-.



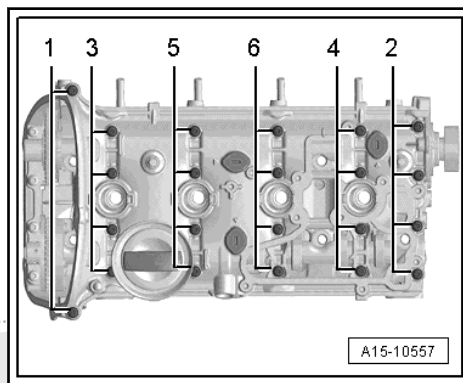
- Remove the bolts -arrows-.
- Remove the air guide pipe bolt -arrow-.



- Loosen the hose clamp -2- and remove the air guide pipe together with the crankcase ventilation.
- Disconnect the vacuum line -1- and free up the wire.



- Remove the connector from the Camshaft Position Sensor G40- -2-.
- Remove the cylinder head cover bolts in sequence -1 to 6-.
- Remove the cylinder head cover.
- Remove camshafts.
- Prevent dirt and sealant residue from entering cylinder head.



### Installing

- ◆ Tightening specifications. Refer to ➤ [-1.5 Valvetrain](#), page [106](#).



#### Note

- ◆ *Sealing surfaces must be completely free of oil and grease.*
- ◆ *The pistons must not be positioned at TDC.*
- ◆ *Make sure that all roller rocker levers make contact correctly on valve stem ends.*
- ◆ *Note the expiration date of the Silicone Sealant.*
- ◆ *The cylinder head cover must be installed within 5 minutes after applying the Silicone Sealant.*
- Remove any sealant residue on the cylinder head using the flat-blade scraper.



#### WARNING

***Danger of eye injury.***

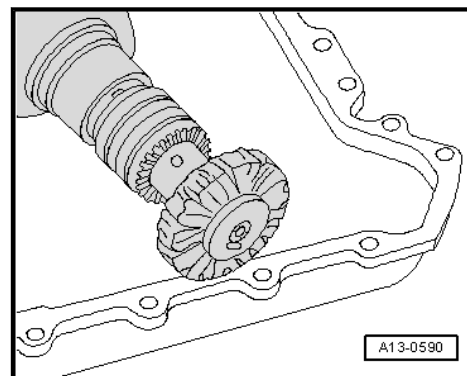
- ◆ ***Wear protective eyewear.***



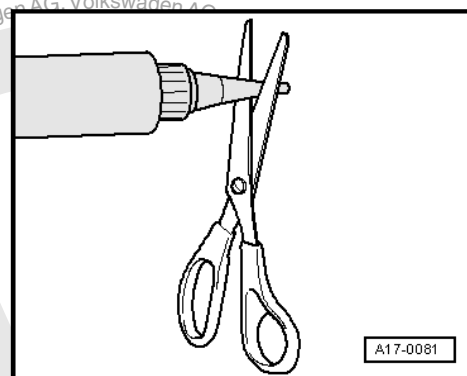
#### Note

*Prevent dirt and sealant residue from entering cylinder head.*

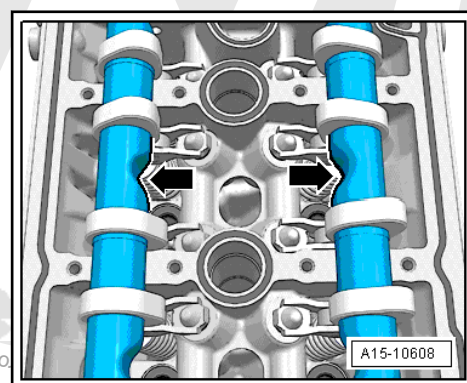
- Remove any sealant residue out of the groove in the cylinder head cover as well as from any sealing surface using, for example, a rotating plastic brush.



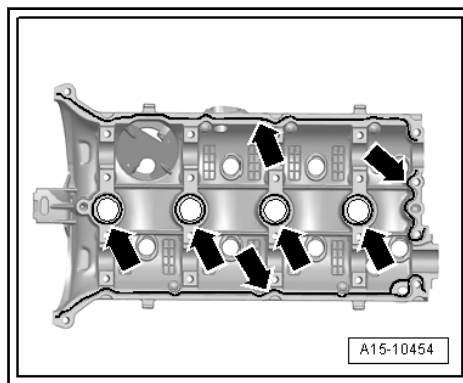
- Clean the sealing surfaces. They must be free of oil and grease.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).



- Lubricate the running surfaces of both camshafts.
- Place the camshaft into the cylinder head; the recesses -arrows- must be perpendicular to each other.



- Replace the cylinder head cover bolts.
- Apply the Silicone Sealant on the clean sealing surface of the cylinder head cover as shown -arrows-.



- Sealant bead thickness: 2 to 3 mm.



#### Note

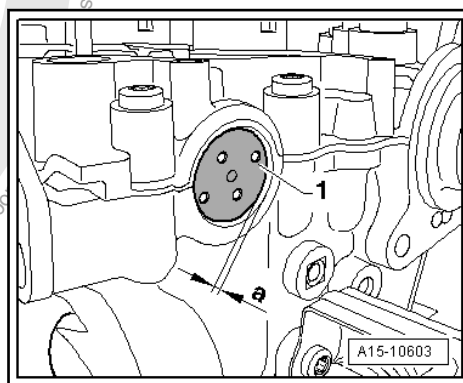
- ◆ The cylinder head cover must be installed within five minutes after application of Silicone Sealant.
- ◆ The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.
- ◆ Pay attention to the expiration date of the sealant.
- Tighten the bolts in several steps:
- Tightening sequence and specification. Refer to ➤ Fig. “Cylinder Head Cover, Tightening Sequence and Tightening Specification”, page 108.



#### Note

Make sure the cylinder head cover is not tilted.

- Insert the cap -1- without sealant using the Seal Installer - Selector Shaft Oil Seal -T10174-.



- Dimension -a-: 1 to 2 mm

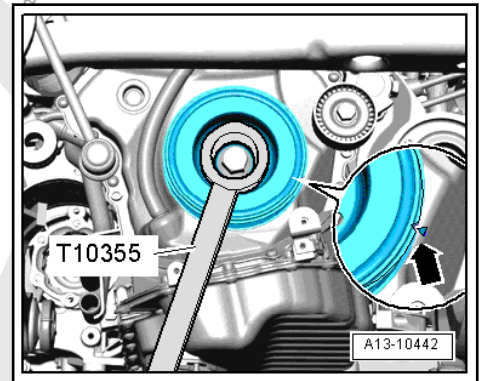


#### Caution

When rotating the crankshaft, make sure the timing chain cannot damage any other components.



- Turn the vibration damper into “TDC” -arrow- using the Counterhold - Vibration Damper -T10355A-.



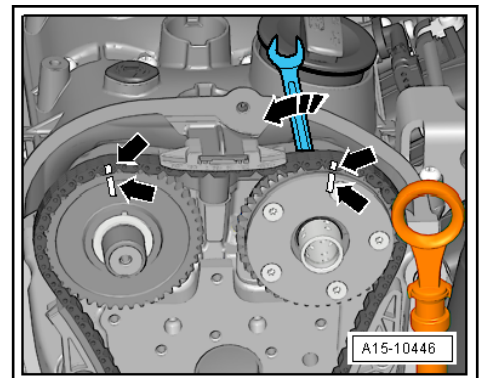
- The notch on the vibration damper must align with the arrow marking on the lower timing chain cover.



#### Note

*The marked chain links for the timing chain must be positioned at the markings on the chain sprockets.*

- Mount the camshaft timing chain:



- The markings drive chain/chain sprockets -arrows- must align.
- Turn the intake camshaft using the wrench in direction of -arrow- and mount the timing chain.

Further assembly is performed the reverse order of the removal.

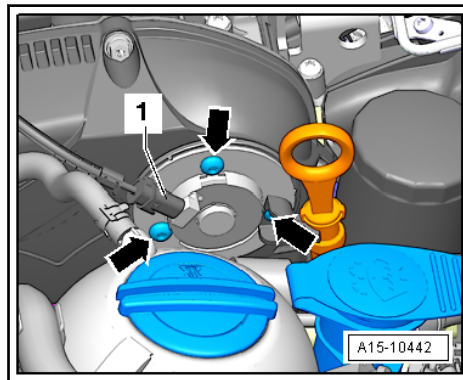
### 3.3 Camshaft Adjustment Valve 1 -N205-

#### Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Torque Wrench 1783 - Open Jaw - 10mm -VAG1783/1-

#### Removing

- If equipped, remove the charge air guide to the sound generator.
- Disconnect the connector from the Camshaft Adjustment Valve 1 -N205- -1-.



- Remove the bolts -arrows- and then remove the Camshaft Adjustment Valve 1 -N205-.

### Installing

Install in reverse order of removal. Note the following:

- Coat the sealing ring and the O-ring with engine oil.
- ♦ Tightening specifications. Refer to [⇒ -1.4 Timing Chain Cover-, page 103](#).

## 3.4 Camshaft Timing Chain, Removing and Installing

### Special tools and workshop equipment required

- ♦ Assembly Tool -T10352C- (engine code CCZA: Assembly Tool -T10352/1A-)
- ♦ Counterhold - Vibration Damper -T10355A-
- ♦ Locking Pin (3 pcs) -T40011-
- ♦ Chain Tensioner Lever -T40243-
- ♦ Tensioner Locking Tool -T40267-
- ♦ Camshaft Locks -T40271-
- ♦ Vibration Damper Assembly Tool -T10531-

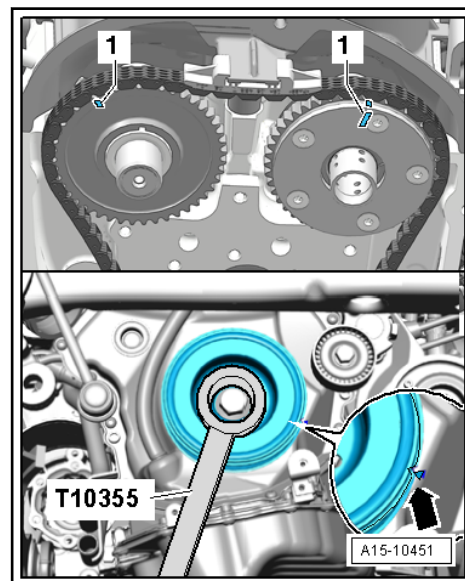
Individual components of the Vibration Damper Assembly Tool -T10531-

- ♦ Vibration Damper Assembly Tool - Counterhold Tool - T10531/1-
- ♦ Vibration Damper Assembly Tool - Tensioning Pins - T10531/2-
- ♦ Vibration Damper Assembly Tool - Turning Over Tool - T10531/3-
- ♦ Vibration Damper Assembly Tool - Knurled Nut -T10531/4-

### Removing

- Remove the upper timing chain cover. Refer to [⇒ T3.9 Timing Chain Cover-, page 176](#).
- Rotate the vibration damper using the Counterhold - Vibration Damper -T10355- into the “TDC” position -arrow-.





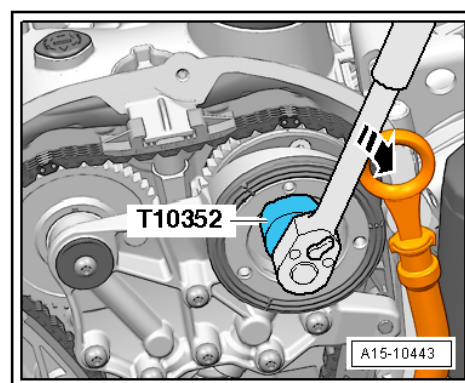
- The notch on the vibration damper must line up with the arrow marking on the lower timing chain cover.
- The markings -1- on the camshafts must point upward.
- Remove the vibration damper. Refer to ➤ [D5.9 amper, Removing and Installing](#), page 78 .
- Remove the lower timing chain cover. Refer to ➤ [T3.8 iming Chain Cover](#), page 169 .



#### Caution

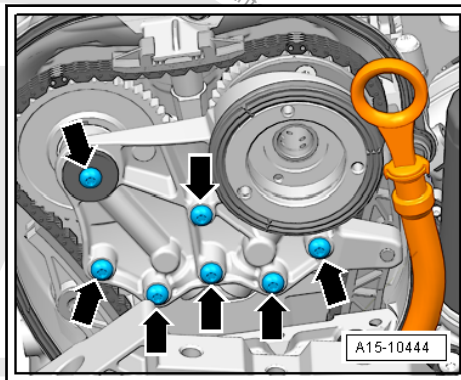
*The control valve has a left thread.*

- Remove the control valve in the direction of -arrow- using the Assembly Tool -T10352C- (for engine code CCZA, use Assembly Tool -T10352/1A-).

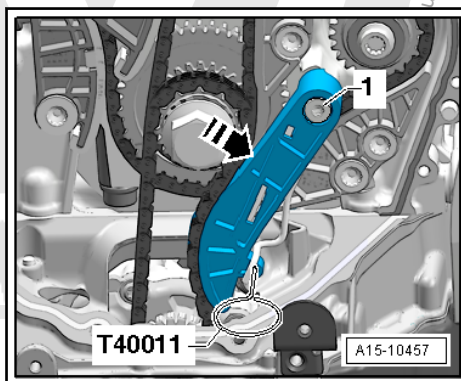


- Remove the bolts -arrows- and remove the bearing bracket.

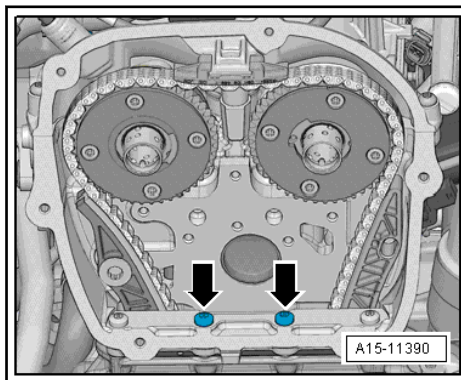




- Press the oil pump chain tensioner in the direction of -arrow- and secure it with a Locking Pin -T40011-.

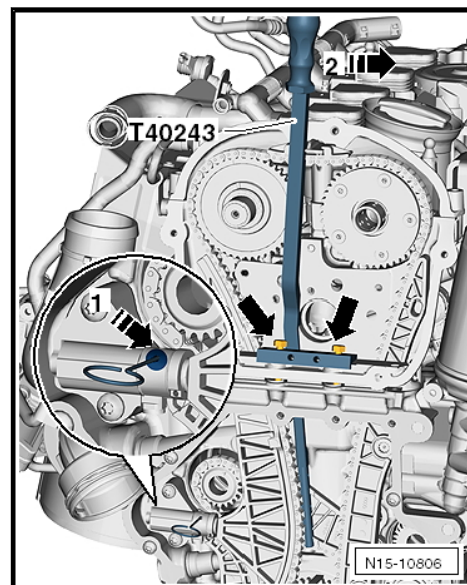


- Remove the bolts -arrows-.





Two different chain tensioners may be installed depending on the version, Version 1:



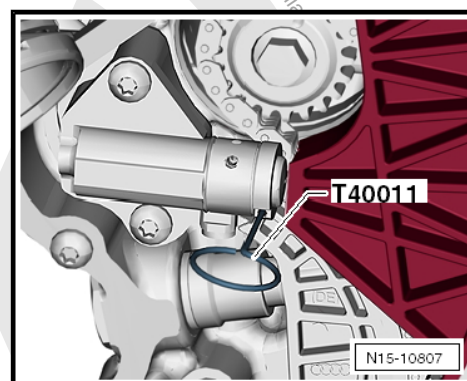
- Install the Chain Tensioner Lever -T40243- -arrows-.
- Lift up the locking wedge for the chain tensioner in direction of -arrow 1-. Sand the end of the Locking Pin (3 pc.) -T40011- down to a point. A screwdriver with a head approximately 1.5 mm wide can also be used.



#### Caution

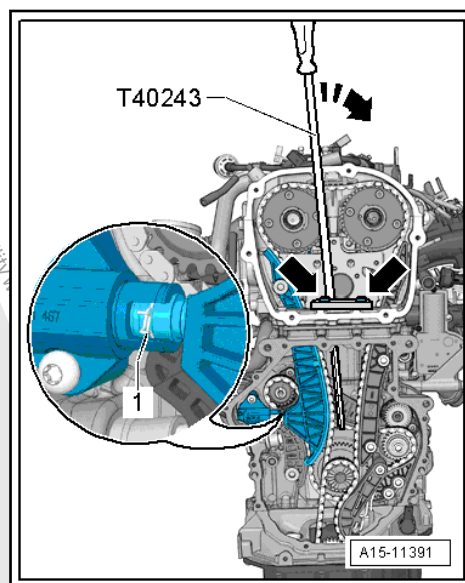
***There is a risk of damaging the chain tensioner. Proceed very carefully.***

- Slowly press and hold the Chain Tensioner Lever -T40243- in the direction of -arrow 2-.
- Secure the chain tensioner using the Locking Pin (3 pc.) -T40011-.



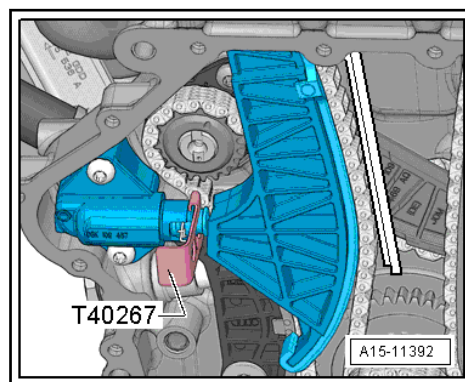


**Version 2:**

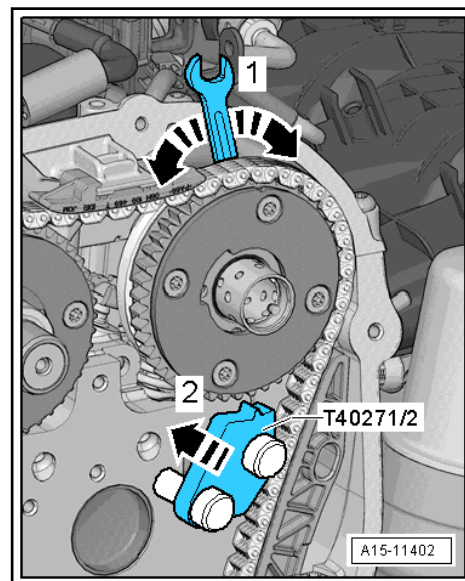


Install the Chain Tensioner Lever -T40243- -arrows-.

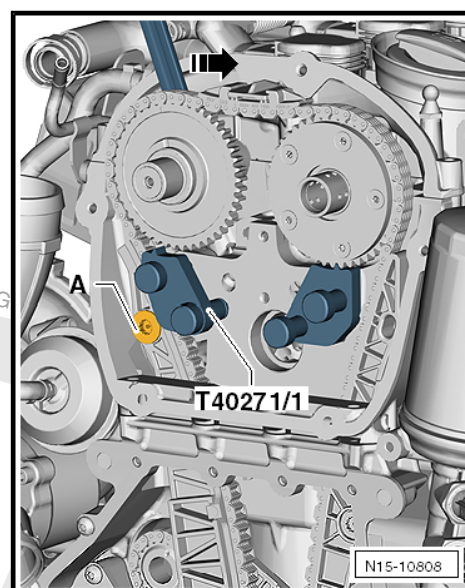
- Press the chain tensioner locking ring -1- together and hold it.
- Slowly press and hold the Chain Tensioner Lever -T40243- in the direction of -arrow-.
- Secure the chain tensioner with the Tensioner Locking Tool -T40267-.



- Remove the Chain Tensioner Lever -T40243-.
- Bolt the Camshaft Locks - Component 2 -T40271/2- to the cylinder head and into the splines on the chain sprocket in the direction of the -arrow 2-. If necessary, turn the intake camshaft slightly with a wrench -1-.

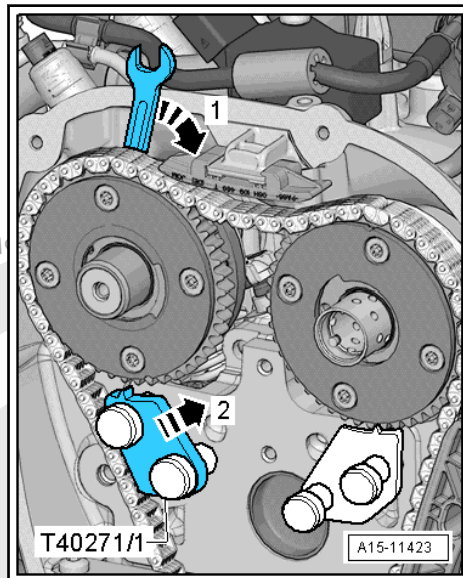


- Bolt the Camshaft Lock - Component 1 -T40271/1- to the cylinder head. Hold the camshaft clockwise -arrow- using a wrench.

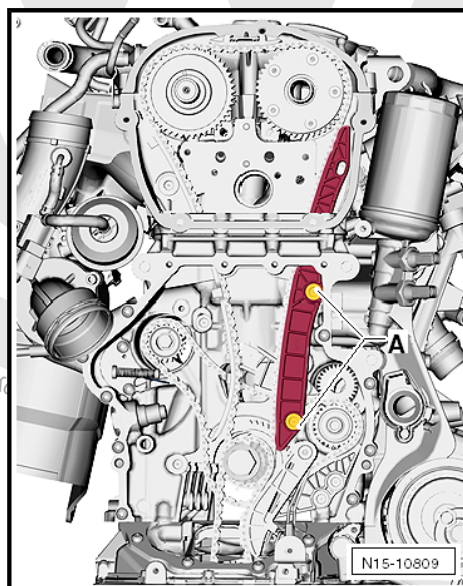


- Remove the bolt -A- and remove the tensioning rail while continuing to hold the camshaft.
- Slide the Camshaft Lock -T40271/1- into the chain sprocket splines -2-; if necessary, turn the exhaust camshaft clockwise -1- until the camshaft lock can be inserted. The camshaft timing chain must be »loose« between the chain sprockets.

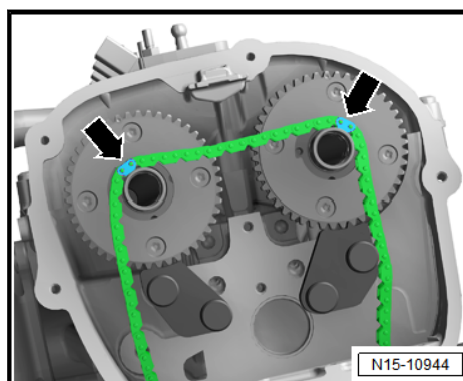




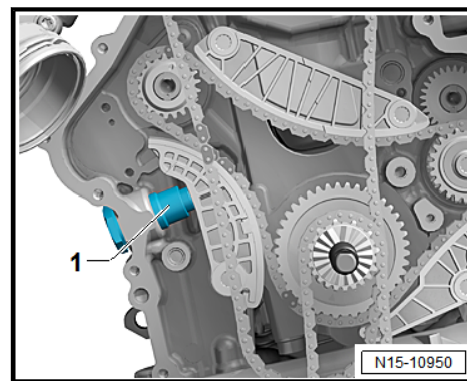
- Remove the bolts -A- and then remove the camshaft timing chain guide rail.



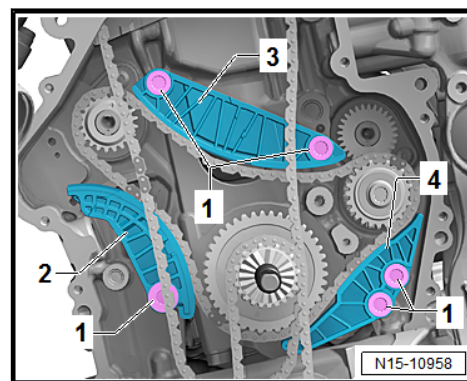
- Remove the camshaft timing chain from the camshaft sprockets and hang it on the camshaft pins -arrows-.



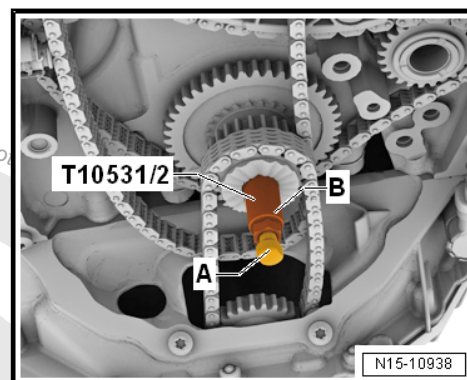
- Remove the chain tensioner -1- for the drive chain balance shaft.



- Remove the bolts -1-. Remove the tensioning rail -2- and the guide rail -3 and 4-.



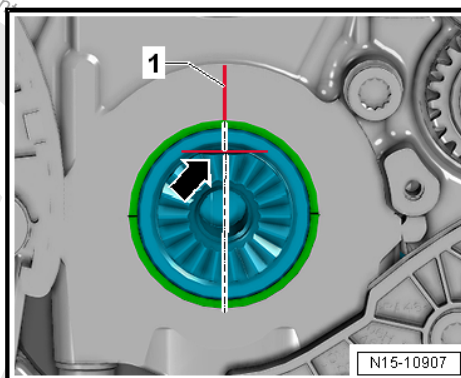
- Loosen the adjusting bolt -A- and remove the tensioning pin -B-.



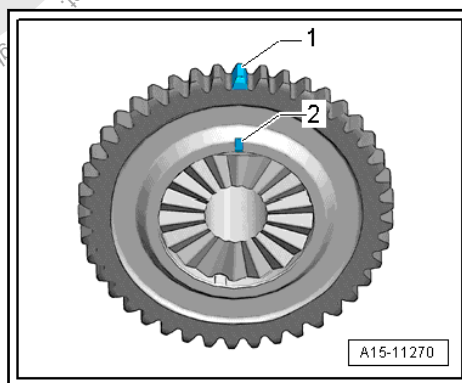
- Remove the three stage chain sprocket by removing the drive chain for the oil pump.
- Remove camshaft timing chain.



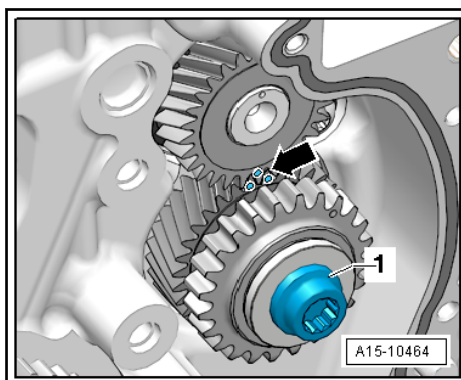
## Installing



- Tightening specifications. Refer to ➤ [-1.2 Camshaft Timing Chains- page 96](#).
- Check that the crankshaft is at TDC. The flat area on the crankshaft -arrow- must be horizontal.
- Draw the marking on the cylinder block -1- with a waterproof marker as shown.
- Draw a marking -2- on the three stage chain sprocket tooth -1- with a waterproof marker.

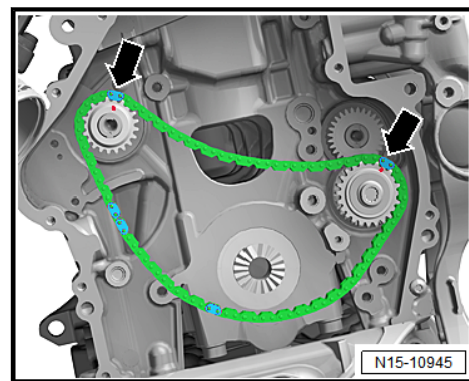


- Turn the intermediate sprocket and balance shaft to the mark -arrow-, but do not loosen the bolt -1-. The marking on the intermediate sprocket and the balance shaft are difficult to see and align only every seventh turn.

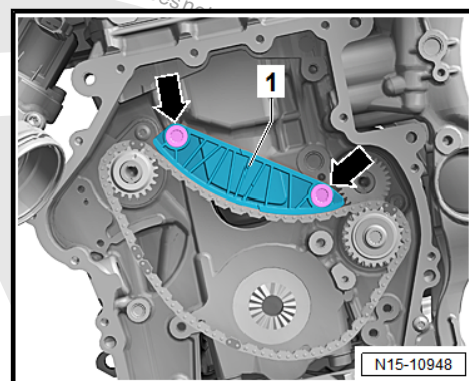


- Lay the balance shaft drive chain, and position the painted links -arrows- with the markings on the chain sprockets.

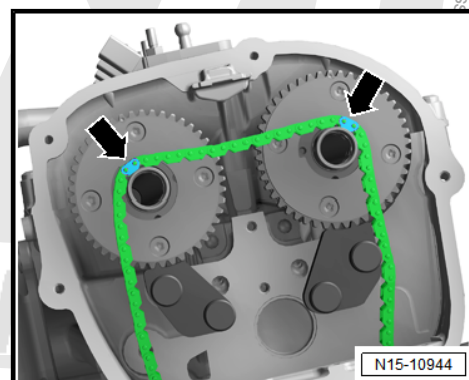




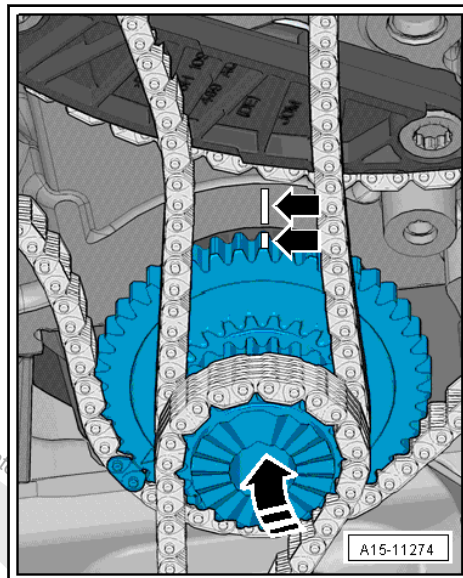
- Install the guide rail -1- and tighten the bolts -arrows-.



- Engage the camshaft timing chain with the painted links -arrows- on the camshaft pins.

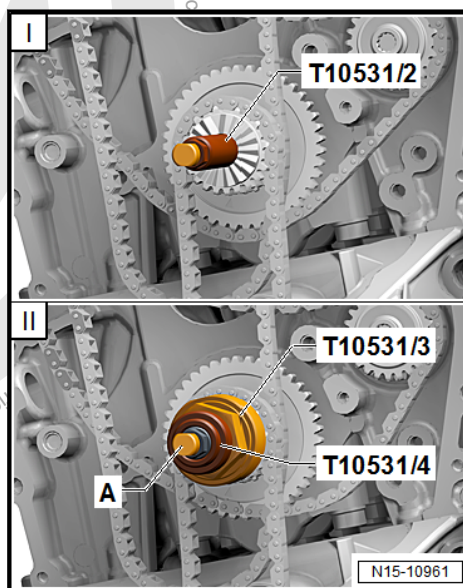


- Lay the oil pump drive chain on the three-stage chain sprocket.



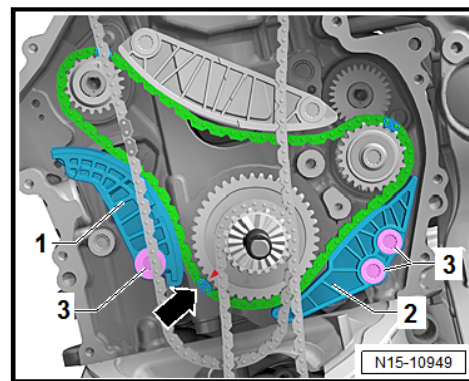
- Tilt the three stage chain sprocket in the direction of -arrow- toward the engine and secure it to the crankshaft. The marks -arrows- must be positioned opposite each other.

I - Install the Assembly Tool - Tensioning Pins -T10531/2- in the crankshaft and tighten hand-tight.

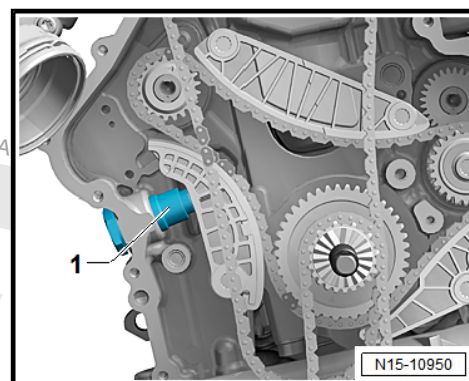


II - Install the Assembly Tool - Turning Over Tool -T10531/3-. Tighten the Assembly Tool - Knurled Nut -T10531/4- hand tight. Using a 32 mm open end wrench move the turning over tool back and forth slightly while tightening the knurled nut until the chain sprocket is seated securely on the crankshaft splines. Now tighten the adjusting bolt -A-.

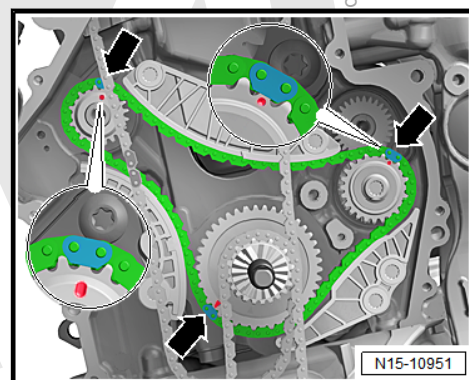
- Position the painted chain link in the balance shaft drive chain -arrow- at the mark on the three stage chain sprocket. Install the tensioning rail -1- and the guide rail -2-. Tighten bolts -3-.



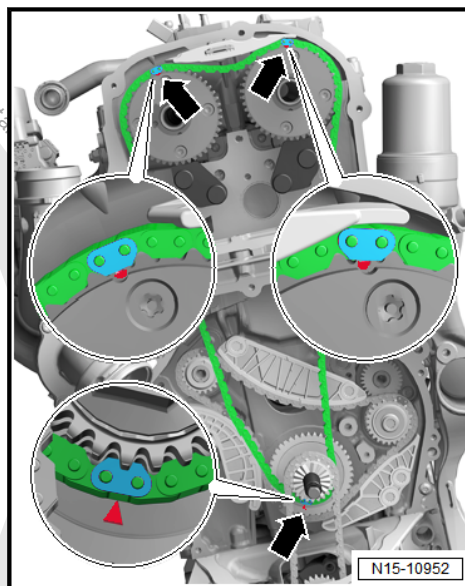
- Install the chain tensioner -1-.



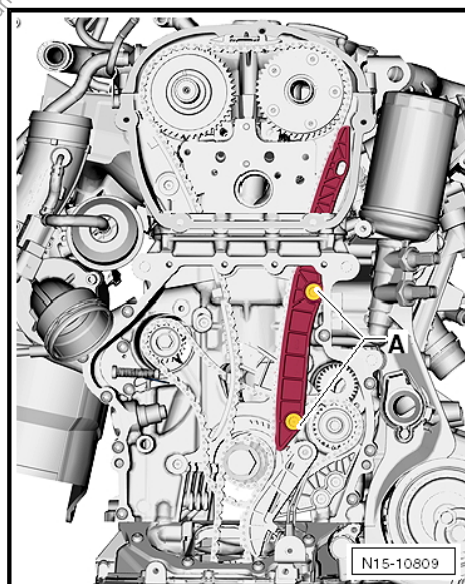
- Check the adjustment again. The painted chain links -arrows- must line up with the markings on the chain sprockets.



- Place the camshaft timing chain on the intake camshaft, exhaust camshaft and the crankshaft. Position the painted chain links -arrows- at the markings on the chain sprockets.



- Install the camshaft timing chain guide rail and tighten the bolts -A-.

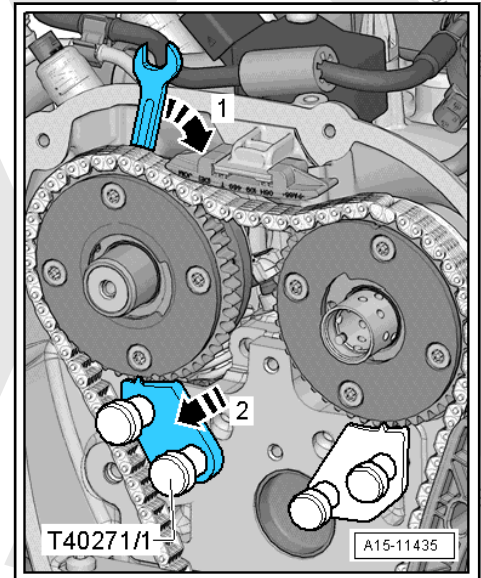


#### Note

*Use the help of a second technician to hold the exhaust camshaft in place.*

- Slowly turn the exhaust camshaft in the direction of the -arrow 1- until the Camshaft Locks -T40271/1- can be pulled out of the chain sprocket splines.





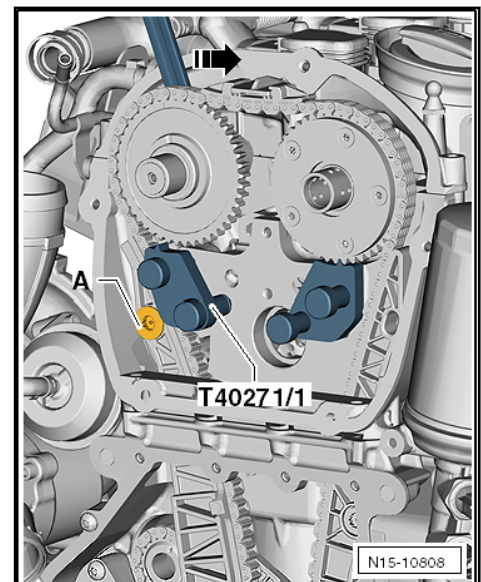
- Carefully release the camshaft, until the camshaft timing chain is laying on the upper guide rail. Hold the camshaft in this position.



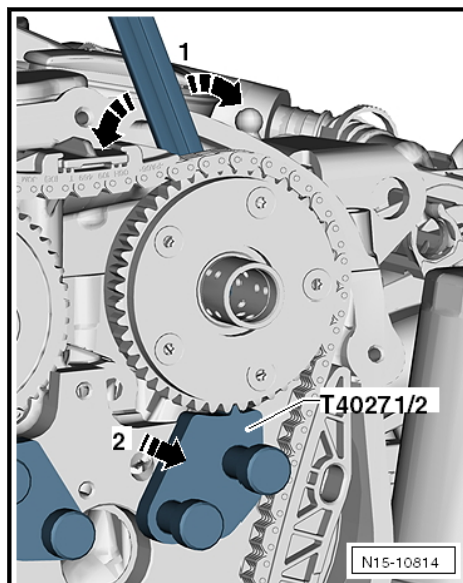
#### Caution

***Always check before installing the tensioning rail, whether the colored chain link is still aligned to the markings on the camshaft!***

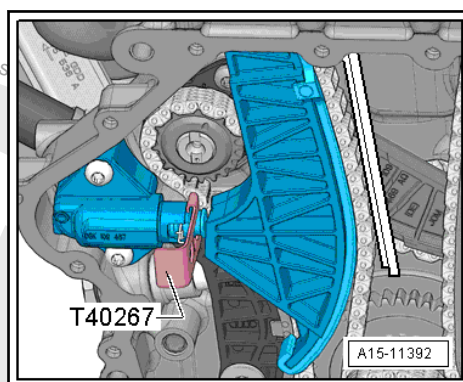
- Continue to hold the camshaft and install the camshaft timing chain tensioning rail. Tighten bolt -A-.



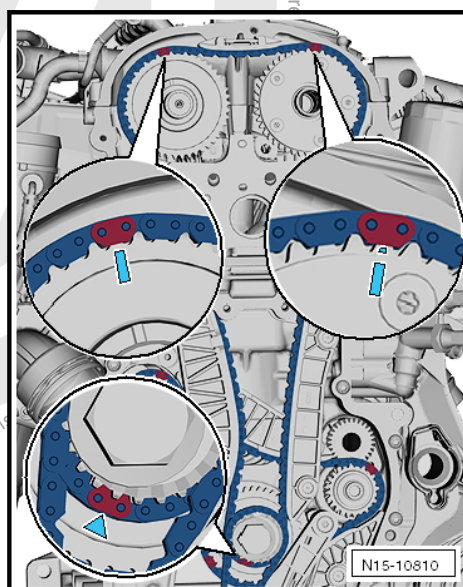
- Remove the Camshaft Lock -T40271/1-.
- Slide the Camshaft Lock -T40271/2- out of the chain sprocket splines -2-. If necessary, slightly turn the intake camshaft with the wrench -1-.



- Remove the Camshaft Lock -T40271/2-.
- Depending on the version, remove either the Locking Pin (3 pc.) -T40011- or the Tensioner Locking Tool -T40267-.

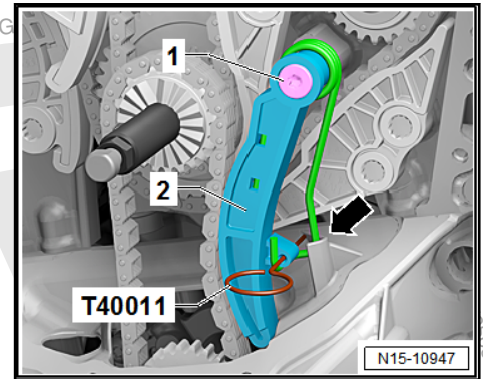


- Check that the position of the colored chain link is aligned to the markings.

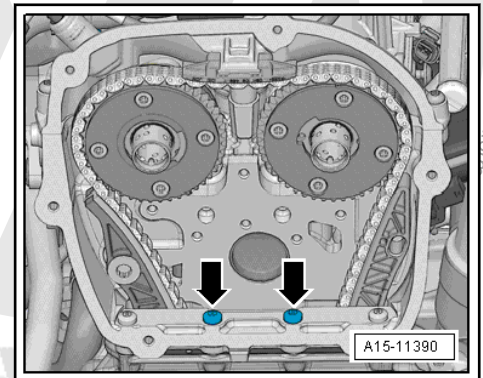




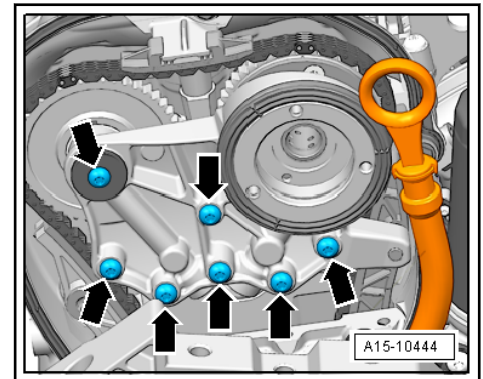
- Install the chain tensioner -2-. The wire clip -arrow- must come in to contact with the oil pan upper section opening. Tighten the bolt -1- and remove the Locking Pin -T40011-.



- Install the screws -arrows- and tighten.

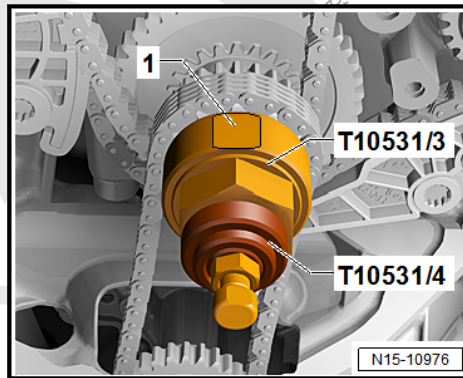


- Carefully mount the bearing bracket without tilting it. Hand-tighten the bolts -arrows-.



- Tighten the bearing bracket bolts -arrows-. Refer to ➤ [-1.2 Camshaft Timing Chains-, page 96](#).
- Install the control valve -item 6- ➤ [Item 6 \(page 97\)](#).
- Turn the crankshaft with a 32 mm open end wrench on the Vibration Damper Assembly Tool - Turning over tool -T10531/3- two times in the direction of engine rotation. When in the “TDC point”, the flat area -1- points upward.





#### Note

*Due to the ratio, the colored chain links no longer match up after the engine has been turned.*

Further assembly is performed in the reverse order of the removal.

## 3.5 Cylinder Head

### Special tools and workshop equipment required

- ◆ Engine Sling -2024A-
- ◆ Engine Support -T10014-
- ◆ Central Valve Assembly Tool -T10352-
- ◆ Counterhold - Vibration Damper -T10355-
- ◆ Locking Pin (3 pc.) -T40011-
- ◆ Puller - Ignition Coil -T40039-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Shop Crane -VAS6100-
- ◆ Engine Bung Set -VAS6122-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Polydrive Bit Drive Socket -T10070-
- ◆ Cable Tie

### Removing



#### Note

*All cable ties which are opened or cut open when removing, must be replaced in the same position when installing.*

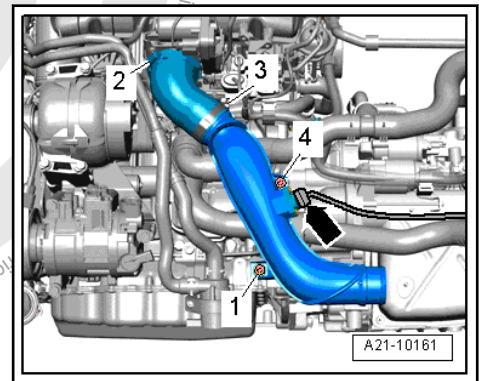


#### Caution

*When doing any assembly work, especially in the engine compartment, pay attention to the following due to the limited space.*

- ◆ *Route lines of all types (for example for fuel, hydraulic, Evaporative Emission (EVAP) canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.*

- Lower the pressure in the high pressure area of the fuel system. Refer to ⇒ [P1.2 recautions](#), page 2 .
- Switch off the ignition and all electrical consumers and remove the key.
- Remove the engine cover. Refer to ⇒ [C3.1 over](#), page 17 .
- Remove the air filter. Refer to ⇒ [F4.2 ilter Housing](#), page 404 .
- Loosen the hose clamp -2-.



- Remove the bolt -4-.
- Disconnect the connectors -arrow- and free up the electric wire.



#### WARNING

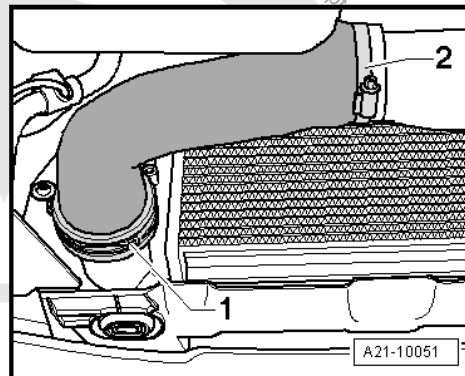
*Risk of scalding due to hot steam and hot coolant:*

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Wear protective eyewear and protective clothing to prevent eye injury and scalding.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

- Open cap on coolant expansion tank.
- Remove the front exhaust pipe with catalytic converter. Refer to ⇒ [E3.2 xhaust Pipe](#), page 444 .
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.



- Remove right front wheel.
- Remove the right front wheel housing liner. Refer to ➤ **Body Exterior**; Rep. Gr. 66; Removal and Installation.
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



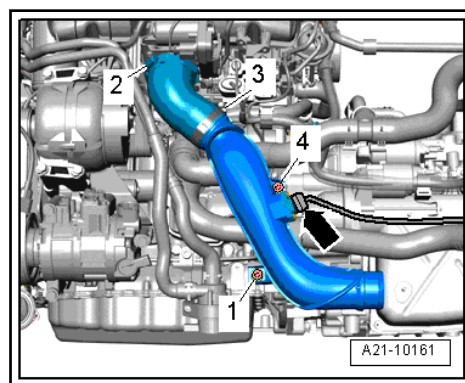
- Seal off the connections on the charge air cooler with a clean cloth.
- Place a Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray - VAS6208- under the engine.



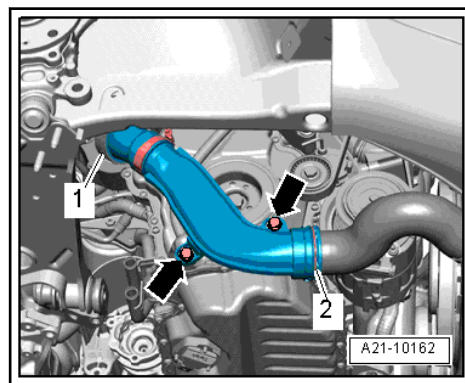
#### Note

*Collect escaping coolant in a clean container for disposal or reuse.*

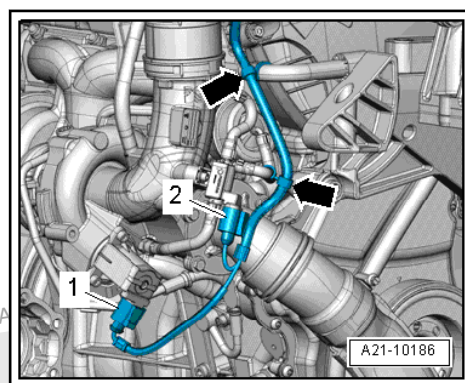
- Drain the coolant. Refer to ➤ **D1.1 draining and Filling**, page 229.
- Remove the bolt -1- and remove the air guide pipe downward.



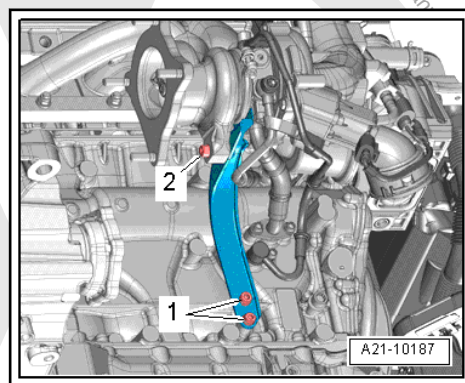
- Remove the bolts -arrows-.



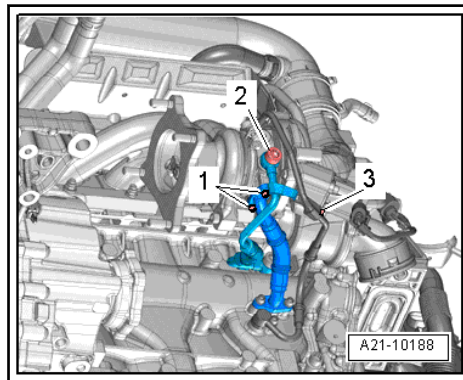
- Remove the air guide pipe by lifting the clamps -1 and 2-.
- Disconnect the connectors -1 and 2- and free up the wire -arrows-.



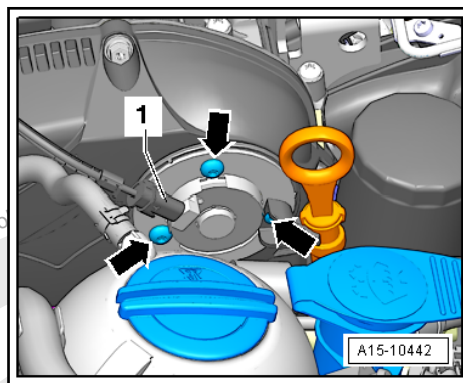
- Remove the bolts -1 and 2- and remove the turbocharger support.



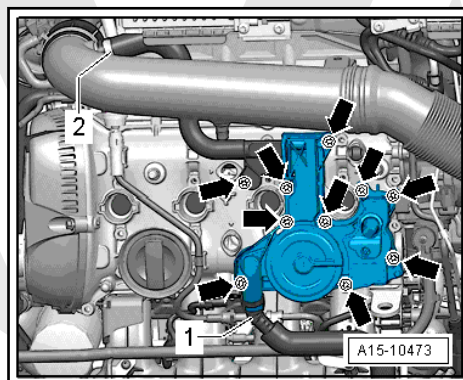
- Remove the banjo bolt -2- and move the coolant line to the side.



- Remove the bolts -1- on the oil return line.
- Remove the bolt -3- on the oil supply line.
- If equipped, remove the charge air guide to the sound generator.
- Disconnect the connector from the Camshaft Adjustment Valve 1 -N205- -1-.

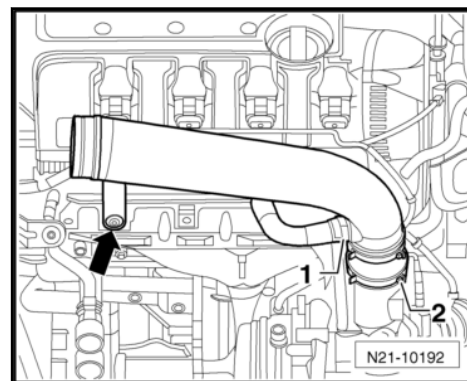


- Remove the Ignition Coils with Output Stages. Refer to ➤ [C4.2 oils with Power Output Stages](#), page 459, and lay the wiring harness to the side.
- Disconnect the crankcase ventilation hose -1-.



- Remove the bolts -arrows-.
- Remove the air guide pipe bolt -arrow-.





- Loosen the hose clamp -2- and remove the air guide pipe together with the crankcase ventilation.

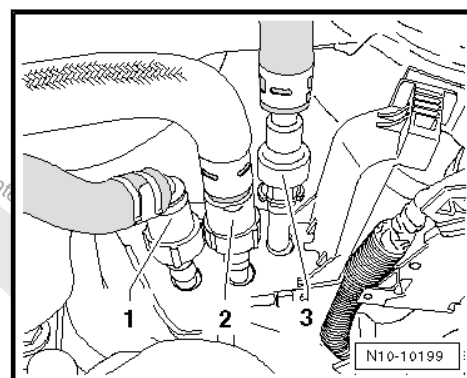


# **WARNING**

***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

- Disconnect the lines on the connection and catch any fuel coming out with a cloth.

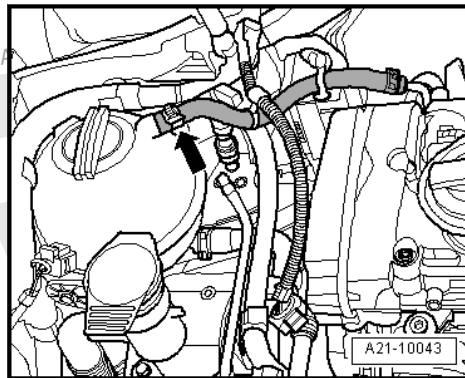


- 1 - Ventilation line (press the circlip to release the line).
  - 2 - Vacuum line (press the circlip to release the line)
  - 3 - Fuel supply line (pull the circlip upward to release the line)
- Disconnect the coolant hose leading to the coolant reservoir -arrow-

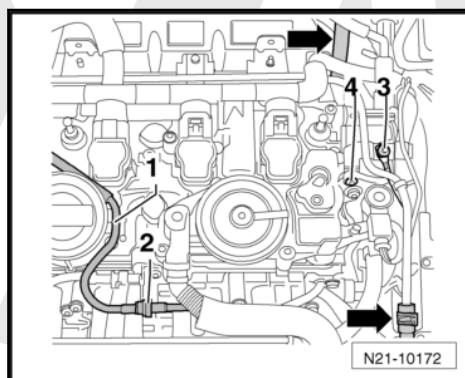




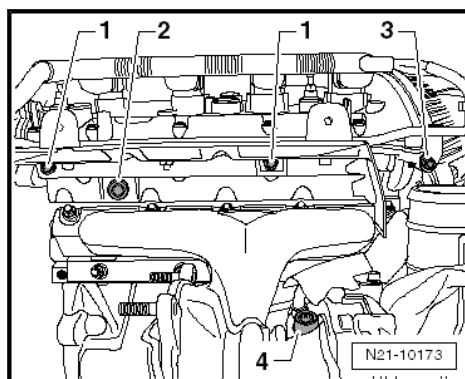
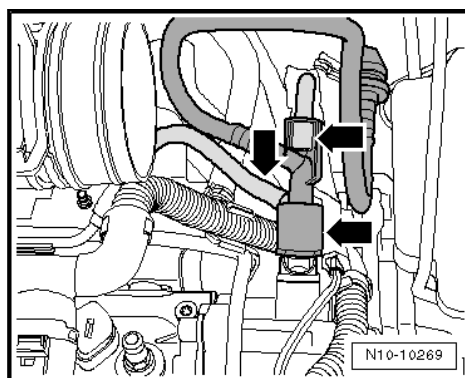
- Remove the coolant hoses -arrows- from the coolant pipe.



- Disconnect the Ground (GND) wire -3- and remove the bolt -4-.
- Disconnect the vacuum hoses -arrows-.



- Remove the bolts -1 through 3- and remove the heat shield together with the coolant pipe.

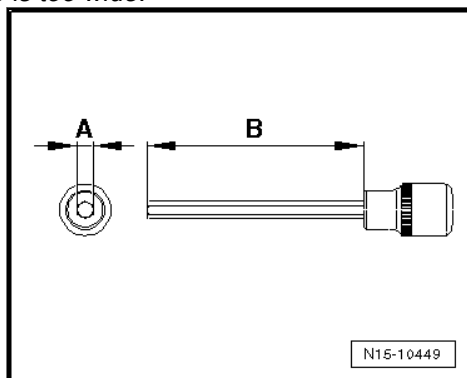




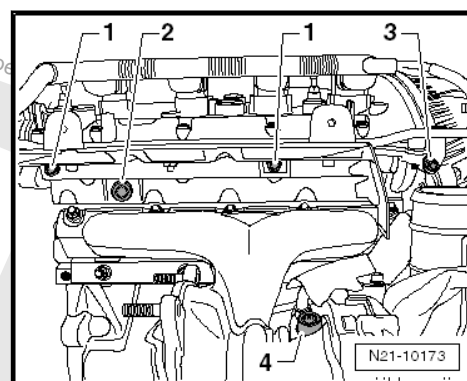
Remove the bolt -2- from the heat shield using a 6 mm wrench.

**i Note**

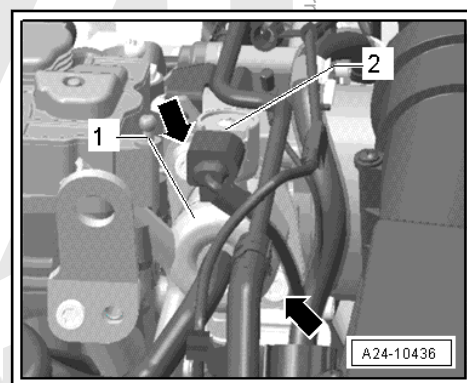
*The hex socket -A- must be at least 5 cm -B- long. A socket that tapers to 6 mm at the tip is too wide.*



- Disconnect the oil supply line from the turbocharger -4-.

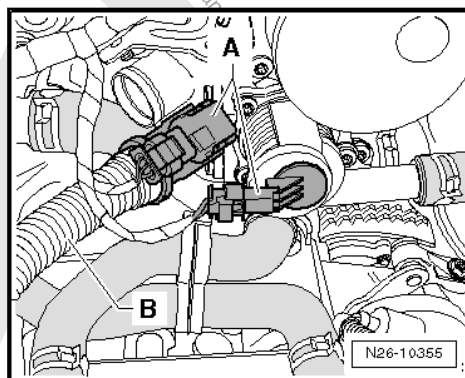


- Disconnect the connector -2- from the Fuel Pressure Regulator Valve -N276-.

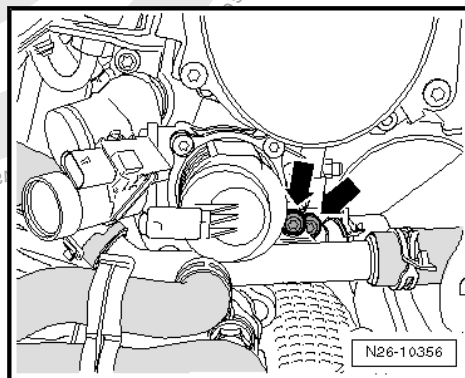




## Engine Code CBFA

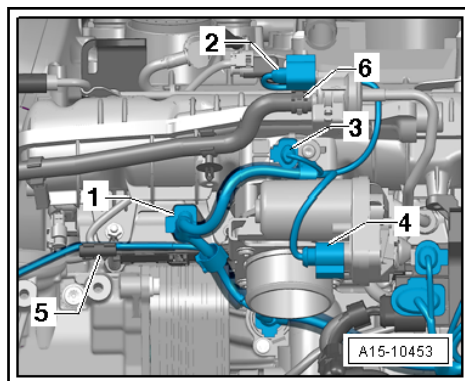


- Disconnect the connector -A- and hose -B- from the Secondary Air Injection Solenoid Valve -N112-.
- Loosen the coolant pipe by removing the bolts -arrows-.

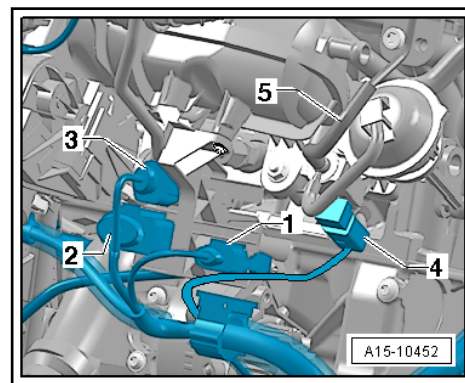


## Continuation for All

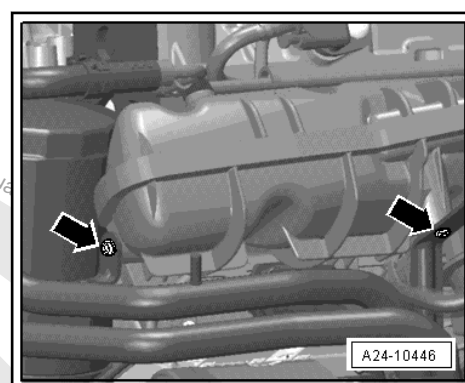
- Disconnect the coolant hose from the side connection on the cylinder head.
- Disconnect the connectors -1 through 4-.



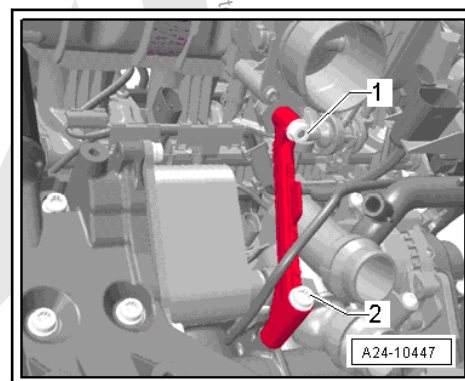
- Free up the wire -5-.
- Disconnect the EVAP canister vacuum hose -6-.
- Disconnect the connector -1- and pull the connectors out of the retainer.



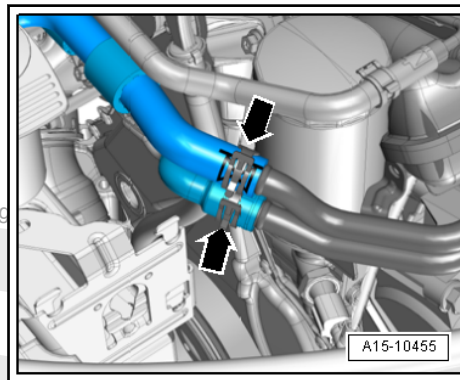
- Disconnect the connectors -2 through 4-.
- Disconnect the coolant line from the intake manifold by the removing the bolts -arrows-.



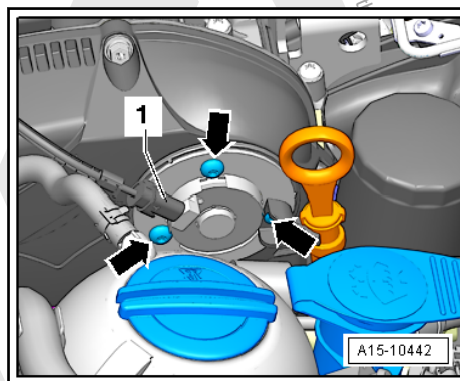
- Remove the intake manifold bracket by removing the mounting nut -1- and bolt -2-.



- Remove the oil filter. Refer to ➤ [-2.2 Oil Filter Housing/Oil Pressure SwitchF1](#), page 201.
- Disconnect the coolant hoses -arrows- and free them up.



- Remove the bolts -arrows- and then remove the Camshaft Adjustment Valve 1 -N205-.



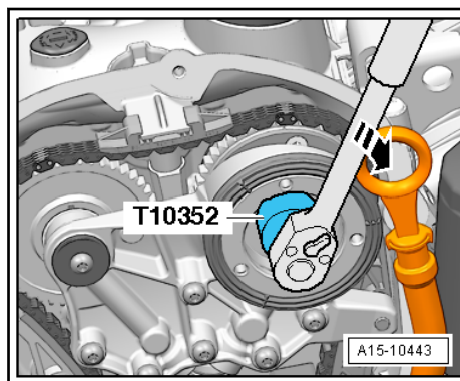
- Remove the upper timing chain cover. Refer to ➔ [T3.9 Timing Chain Cover](#), page 176 .



**Caution**

***The control valve has left-hand thread.***

- Remove the control valve in direction of -arrow- using the Central Valve Assembly Tool -T10352-.

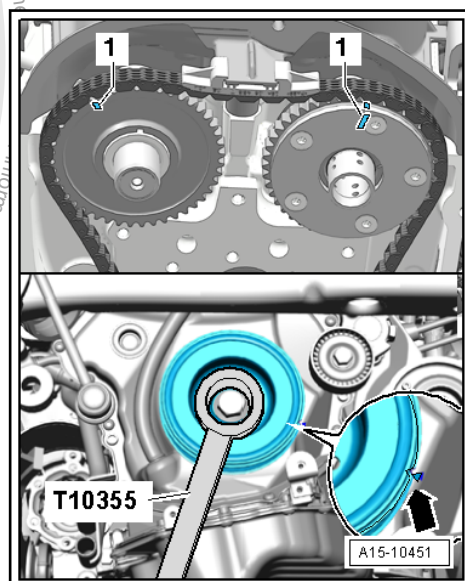
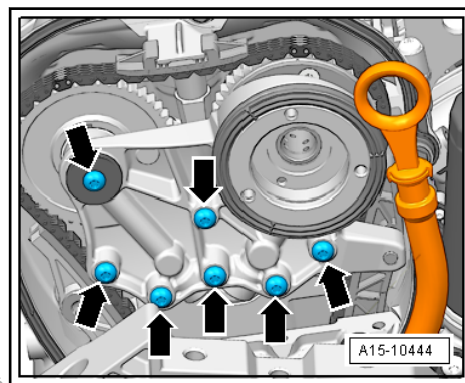


- Remove the bolts -arrows- and remove the bearing bracket.

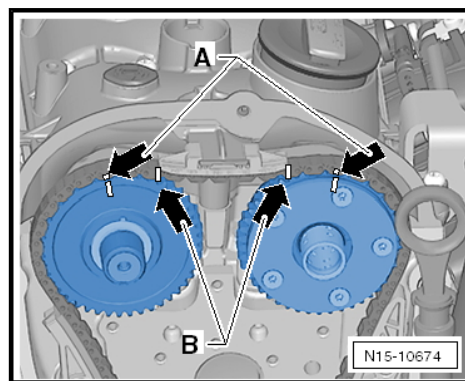




- Rotate the vibration damper using the Counterhold - Vibration Damper -T10355- into the “TDC” position -arrow-.



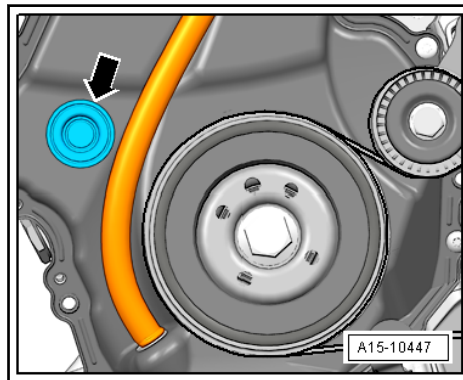
- The notch on the vibration damper must align with the arrow marking on the lower timing chain cover.
- The markings -1- on the camshafts must point upward.
- Carefully mark the position of the drive chain to the chain sprockets -A arrows- with a waterproof marker. Also mark the position of the drive chain to the guide rail -B arrows-.



These marks are necessary for reinstallation.

- Remove the plug -arrow-.





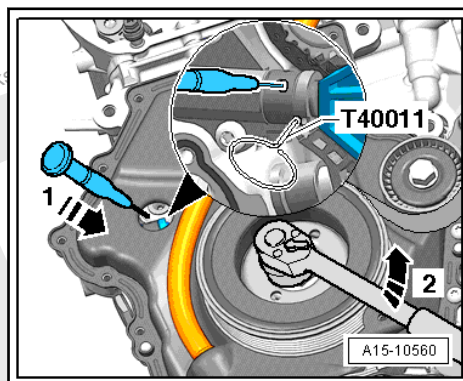
The locking wedge in the chain tensioner must be lifted in order to release the tension from the chain tensioner. Sand the end of the Locking Pin (3 pc.) -T40011- down to a point. A screwdriver with a blade width of approximately 1.5 mm can also be used.



#### Caution

*There is a risk of damaging the chain tensioner. Proceed very carefully.*

- Raise the locking wedge in the chain tensioner Insert the screwdriver in the chain tensioner bore in direction of -arrow 1-.



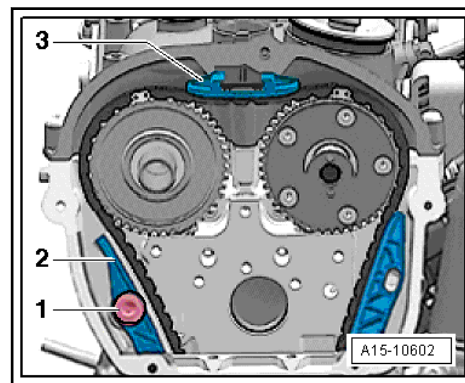
- In order to tension the chain tensioner, turn the crankshaft opposite the direction of engine rotation -arrow 2-. Secure the chain tensioner using the Locking Pin (3 pc.) -T40011-.



#### Note

*The intake camshaft switches in the engine direction of rotation.*

- Remove the bolt -1- and guide the tensioning rail -2- downward.



- Remove the upper guide rail -3- by unlocking the latch (located in the center) with a screwdriver and pushing the guide rail forward.
- Remove camshaft timing chain from chain sprockets.

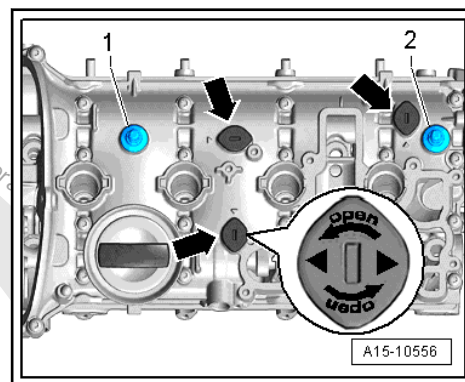


#### Caution

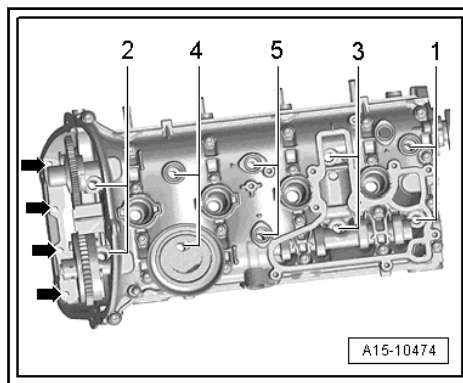
***Danger of damaging the valves, piston head and lower timing chain cover:***

- ◆ ***If the camshaft timing chain was removed from the cylinder head, then the crankshaft may not be turned farther.***
- ◆ ***Panels are installed on the lower timing chain cover to prevent the chain from falling down. The panels can bend if the crankshaft is rotated when the chain is loose.***

- Turn the sealing plugs -arrows- counterclockwise in direction of -arrow- 90° (1/4 turn) and remove.



- Remove the ball head -1 and 2-.
- Remove the cap.
- Remove the bolts -arrows-.

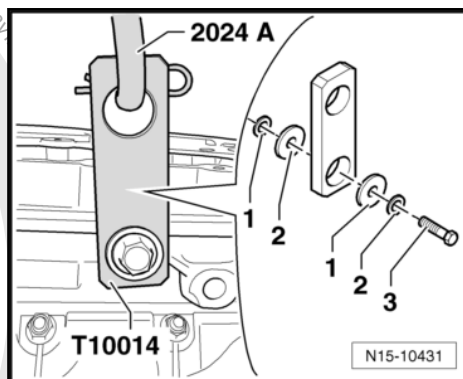


- Remove the cylinder head bolts in sequence -1 through 5- using Polydrive Bit Drive Socket -T10070- until 2 are left.

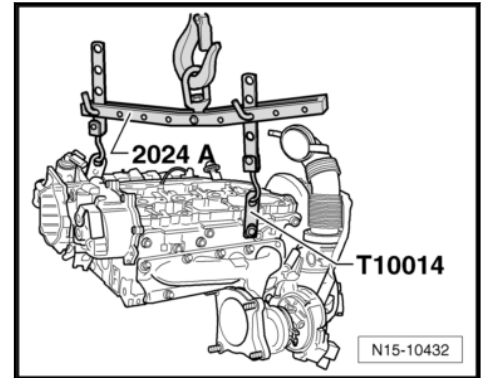


#### Note

- ♦ *To remove the cylinder head bolts, turn the camshaft with a wrench if necessary.*
- ♦ *Make sure all necessary wires are loosened!*
- ♦ *Pay attention to the tension and guide tracks when lifting the cylinder head.*
- Attach the Engine Support -T10014- with each of the two small and large washers, as shown.



- 1 - M8 Washer, Small
- 2 - M8 Washer, Large The outer diameter of the washer must be larger than the hole in the bracket.
- 3 - M8 x 30 Bolt
- Engage the Engine Sling -2024A- into the Engine Support -T10014- and into the left front lifting eye on the cylinder head.
- Engage the Engine Sling -2024A- into the Workshop Crane and lift the cylinder head very gently.



- Remove the last two cylinder head bolts.



#### Caution

- ◆ *Carefully lift the cylinder head until the guide rail for the camshaft timing chain is free.*
- ◆ *The tension- and guide rail must not be damaged.*

- Lay the cylinder head on a soft surface, such as foam.

#### Installing

Tightening specifications. Refer to [⇒ -1.3 Cylinder Head](#), page 98.



#### Caution

**The sealing surfaces could be damaged:**

- ◆ *Carefully remove sealant residue from cylinder head and cylinder block.*
- ◆ *Make sure that no long grooves or scratches result.*

**Risk of damaging the cylinder block:**

- ◆ *There must be no oil or coolant in the blind holes for the cylinder head bolts in the cylinder block.*

**Risk of the cylinder head seal leaking:**

- ◆ *Carefully remove all grinding and sanding residue.*
- ◆ *Only unpack new cylinder head gasket immediately prior to installation.*
- ◆ *To prevent cylinder head seal silicone layer and recessed area from being damaged, always handle seal extremely carefully.*

**Risk of damaging open valves:**

- ◆ *If a replacement cylinder is installed, only remove plastic base right before cylinder head is installed to protect open valves.*

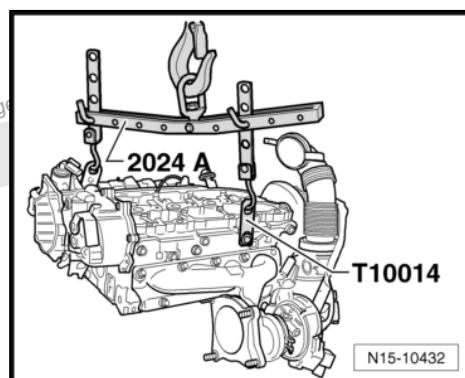
**Risk of damaging valves and piston heads after working on valvetrain:**

- ◆ *To ensure valves do not strike pistons when starting, carefully rotate engine at least two full revolutions.*



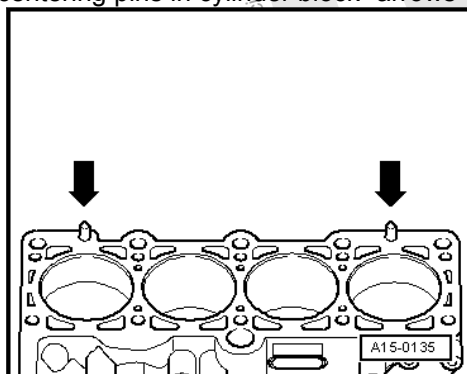
#### Note

- ◆ *Replace the bolts which are being tightened with an additional turn.*
  - ◆ *Replace sealing rings, seals and self-locking nuts.*
  - ◆ *Note different sealant for cylinder head sealing surfaces and bolts.*
  - ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*
  - ◆ *When installing a replacement cylinder head, turn the camshaft to TDC and mark the new chain sprockets exactly the same as on the old chain sprockets (pay attention to the factory colored marking on the chain sprockets).*
  - ◆ *If replacing the cylinder head, all contact surfaces between the bearing elements, roller rocker levers and the cam running surfaces on camshafts must be oiled before installing the cylinder head cover.*
  - ◆ *The engine oil and coolant must be changed if the cylinder head or cylinder head seal are replaced.*
- Hang the cylinder head on the Workshop Crane and position it above the cylinder block.



#### Caution

- ◆ *Carefully lower the cylinder head.*
  - ◆ *The tension- and guide rail must not be damaged.*
- ◆ Pay attention to centering pins in cylinder block -arrows-.





- ◆ Pay attention to the cylinder head gasket installation position: the part number must be readable from the intake side.



#### Caution

*When rotating the crankshaft, make sure the timing chain cannot damage any other components.*

- If the crankshaft was turned in the meanwhile: bring the piston for cylinder 1 to the upper TDC and then turn the crankshaft back just a little.
- Set the cylinder head in place.
- Insert cylinder head bolts and tighten by hand.



#### Note

*In order to be able to turn the cylinder head bolts, the intake camshaft must be turned with a wrench.*

Cylinder head - tightening sequence and tightening specification. Refer to ➔ [Fig. "Cylinder Head, Tightening Sequence and Tightening Specification", page 101](#)



#### Note

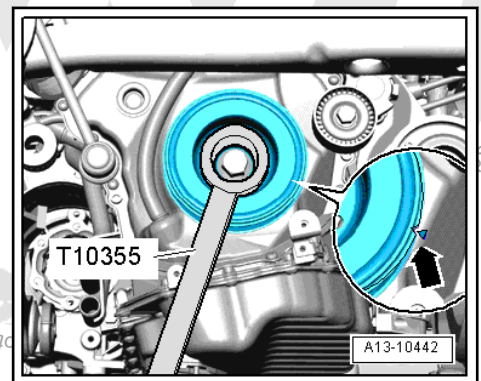
*It is not necessary to retighten the cylinder head bolts after repairs.*



#### Caution

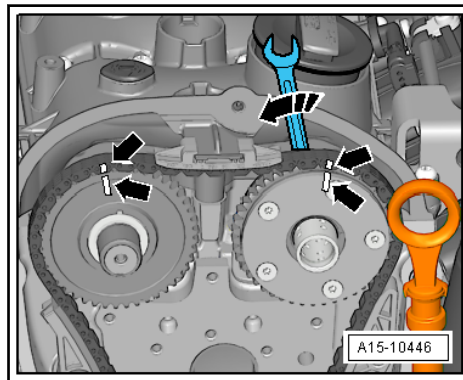
*When rotating the crankshaft, make sure the timing chain cannot damage any other components.*

- Turn the vibration damper into "TDC" - arrow - using the Counterhold - Vibration Damper - T10355A-.

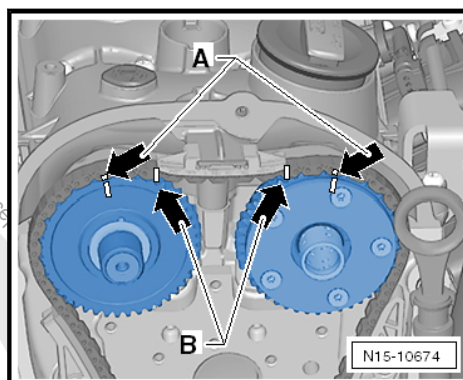


- The notch on the vibration damper must align with the arrow marking on the lower timing chain cover.
- Mount the timing chain on the intake camshaft.

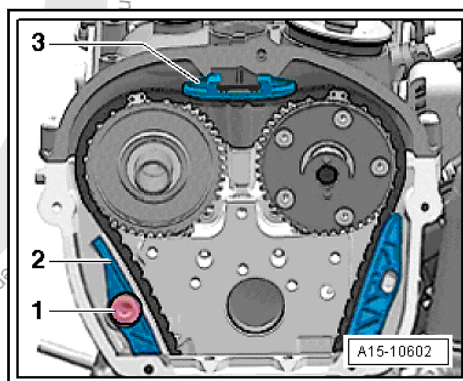




- The markings must align.
- Turn the intake camshaft in direction of -arrow- with a wrench until the timing chain is »taut«. »Hold« the intake camshaft secure in this position.
- Mount the timing chain on the exhaust camshaft.



- The markings on the drive chain and chain sprocket -A arrows- and the drive chain and guide rail -B arrows- must line up with each other.
- Install the upper glide rail -3-.

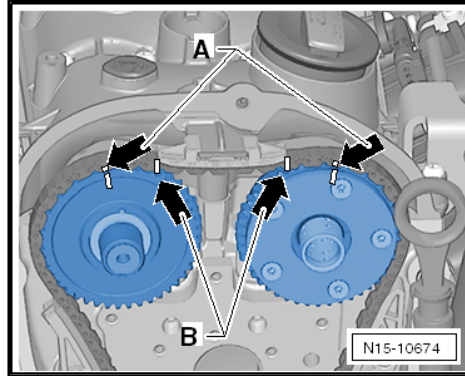


- Move the tensioning rail -2- up and tighten the bolt -1-.



#### Note

If the markings on the drive chain and guide rail -B arrows- do not align even though the engine is at »TDC«, the drive chain has skipped on the crankshaft chain sprocket. Check the valve timing. Refer to ➤ [T2.4 timing, Checking](#), page 112 . If the timing does not agree, the camshaft timing chain must be positioned »again«. Refer to ➤ [T3.4 timing Chain, Removing and Installing](#), page 128 .



Install in reverse order of removal. Note the following:

- Fill with engine oil. Refer to ➤ Maintenance; Booklet 20.1.
- Check oil level. Refer to ➤ [page 195](#) .
- Replace coolant. Refer to ➤ [D1.1 draining and Filling](#), page 229 .
- Check the Engine Control Module Diagnostic Trouble Code (DTC) memory and erase any entries Vehicle Diagnostic Tester "Guided Function".



#### Note

If the DTC memory was erased, the readiness code must be re-generated using the Vehicle Diagnostic Tester in "Guided Fault Finding" function.

### 3.6 Exhaust Camshaft Balance Shaft

#### Special tools and workshop equipment required

- ◆ Puller - Balancer Shaft -T10394-
- ◆ Puller - Unit Injector -T10055-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

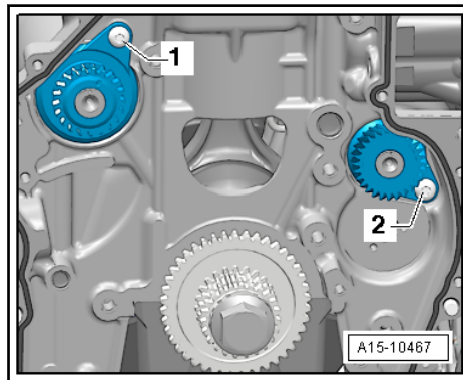


#### Note

Always replace the balance shaft after removing it.

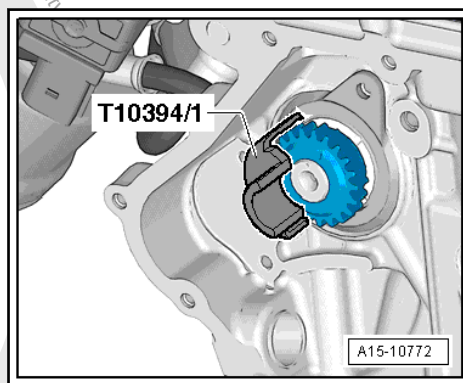
#### Removing

- Remove the balance shaft timing chain. Refer to ➤ [S3.1 half Drive Chain](#), page 115 .
- Remove the bolt -1- and the balance shaft.

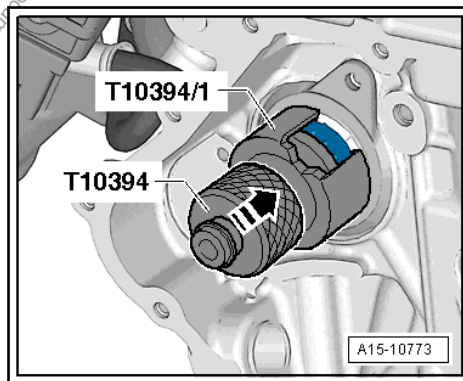


**If the Balance Shaft Cannot be Removed by Hand, Use the Puller - Balancer Shaft -T10394-:**

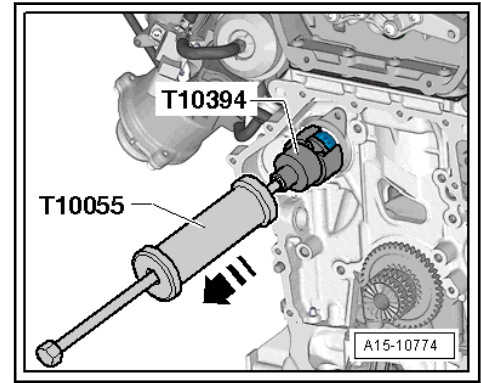
- Insert the Puller - Balancer Shaft - Puller Jaw -T10394/1- from the Puller - Balancer Shaft -T10394-.



- Insert the Puller - Balancer Shaft -T10394- and push the sliding sleeve in direction of -arrow-.



- Install the Puller - Unit Injector -T10055- into the Puller - Balancer Shaft -T10394- and remove the balance shaft.



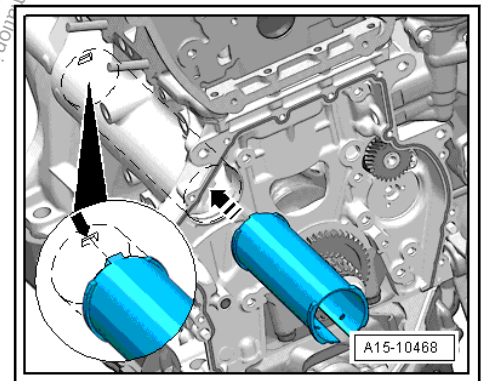
## Installing



### Note

*Because of the small clearance between the balance shaft and cylinder block, the balance shaft may need to be cooled in order to install it. Check if the balance shaft can be inserted into the cylinder block without forcing it in. If it cannot, the balance shaft must be cooled before installing it.*

- ◆ Tightening specifications. Refer to ➤ [-1.1 Balance Shaft Drive Chain](#), page 93, Overview - Balance Shaft Timing Chain.
- Check the installation position of the pipe for the balance shaft -arrow-:

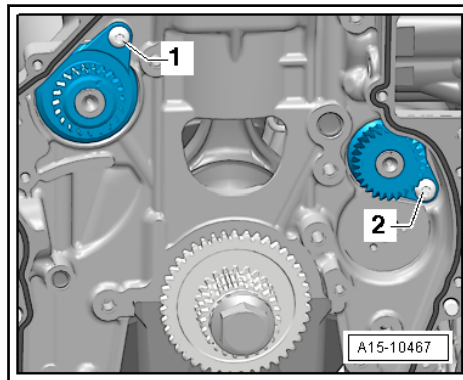


- The pin from the balance shaft pipe must fit into the groove -arrow-



### Note

- ◆ *Press the pipe together slightly to position it in the installation position.*
- ◆ *Press the pipe into the crankcase and bend both halves one time to the inside.*
- Place the new balance shaft in a freezer for 30 minutes or spray it with commercially available cooling spray.
- Lubricate the balance shaft bearing with engine oil.
- Install the exhaust camshaft balance shaft.
- Before tightening the bolt -1- make sure the balance shaft lies level on the crankcase.



#### Note

*If the balance shaft is not level, then the pipe for the balance shaft must be installed again.*

Further assembly is performed the reverse order of the removal.

### 3.7 Intake Camshaft Balance Shaft

#### Special tools and workshop equipment required

- ◆ Puller - Balancer Shaft -T10394-
- ◆ Puller - Unit Injector -T10055-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

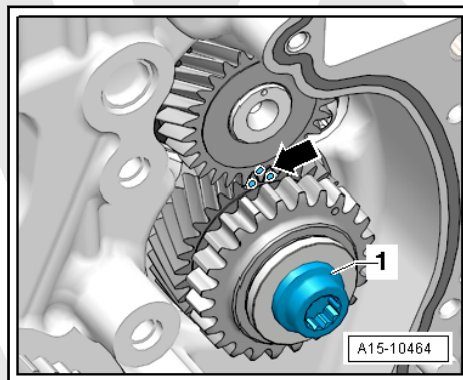


#### Note

*Always replace the balance shaft after removing it.*

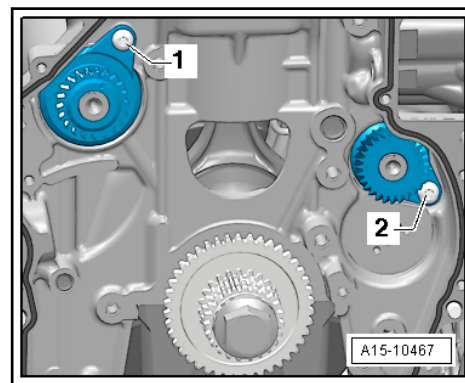
#### Removing

- Remove the balance shaft timing chain. Refer to [⇒ S3.1 haft Drive Chain", page 115](#) .
- Remove the coolant pump toothed belt. Refer to [⇒ P4.3 ump Toothed Belt", page 247](#) .
- Remove the intermediate sprocket -1-.



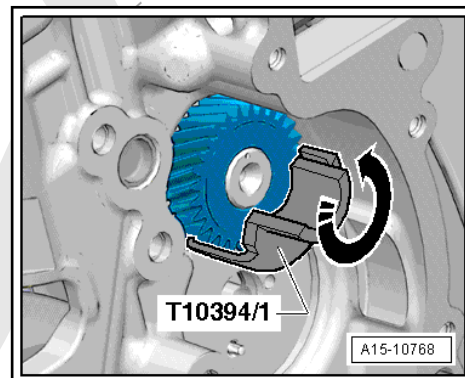
- Remove the bolt -2- for the intake camshaft balance shaft and remove the balance shaft.



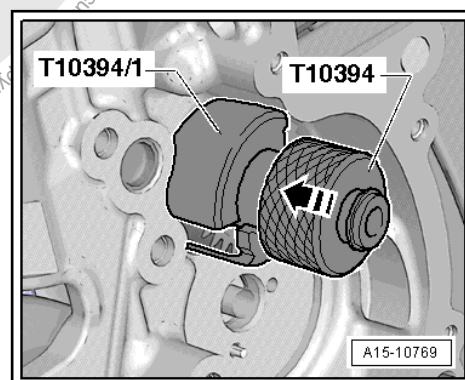


**If the balance shaft cannot be removed by hand, use the Puller - Balancer Shaft -T10394-:**

- Insert the Puller - Balancer Shaft - Puller Jaw - T10394/1- from the Puller - Balancer Shaft -T10394- and turn upward in direction of -arrow-.

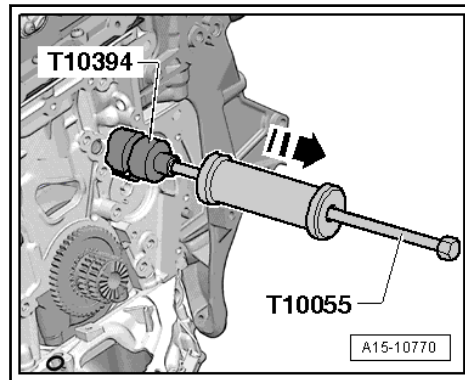


- Insert the Puller - Balancer Shaft -T10394- and push the sliding sleeve in direction of -arrow-.



- Install the Puller - Unit Injector -T10055- into the Puller - Balancer Shaft -T10394- and remove the balance shaft in direction of -arrow-.





## Installing

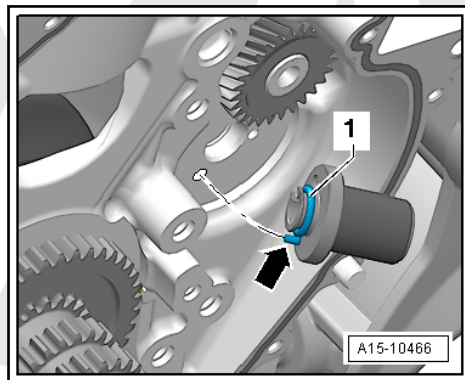


### Note

*Because of the small clearance between the balance shaft and cylinder block, the balance shaft may need to be cooled in order to install it. Check if the balance shaft can be inserted into the cylinder block without forcing it in. If it cannot, the balance shaft must be cooled before installing it.*

◆ Tightening specifications. Refer to ➤ **-1.1 Balance Shaft Drive Chain**, page 93 .

- Place the new balance shaft in a freezer for 30 minutes or spray it with commercially available cooling spray.
- Lubricate the balance shaft bearing with engine oil.
- Install the intake camshaft balance shaft.
- Replace the O-ring -1- and coat with engine oil.



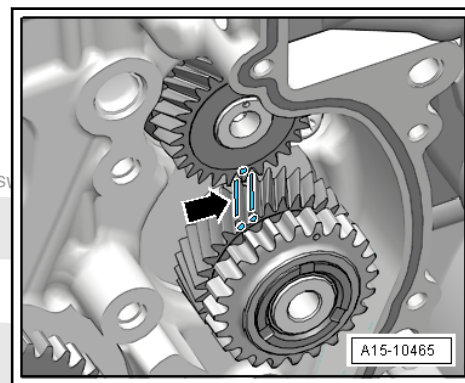
- Coat the mounting pin with engine oil and insert it. The alignment pin -arrow- for the mounting pin must engage in the hole in the cylinder block.



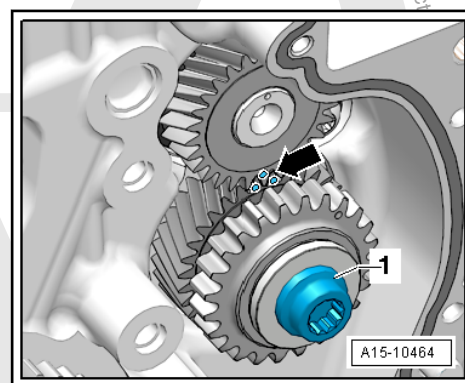
### Caution

***Always replace the intermediate shaft sprocket. Otherwise the backlash will not adjust itself and it could result in engine damage. The new intermediate shaft sprocket has an anti-friction coating that wears off after a short period of use, which automatically adjusts the backlash.***

- Mark the tooth face on the intermediate sprocket -arrows-.



- Install the intermediate sprocket; the marking on the balance shaft must be between the markings on the tooth faces.
- Tighten the chain sprocket bolt -1-:



- Tightening specification. Refer to ➤ [Fig. "Intermediate Shaft Sprocket - Tightening Sequence and Tightening Specification", page 95](#).
- Check the markings on the intermediate shaft sprocket/balance shaft -arrow-.



#### Note

*Due to the ratio, the markings only align after every 7th turn.*

- Install the balance shaft timing chain. Refer to ➤ [page 116](#).

The rest of the assembly is basically a reverse of the removal.  
When at the same time, note the following:

- Replace the coolant pump drive sealing ring ➤ [P4.4 ump Drive Gear Sealing Ring, Replacing", page 250](#).

### 3.8 Lower Timing Chain Cover


#### Special tools and workshop equipment required

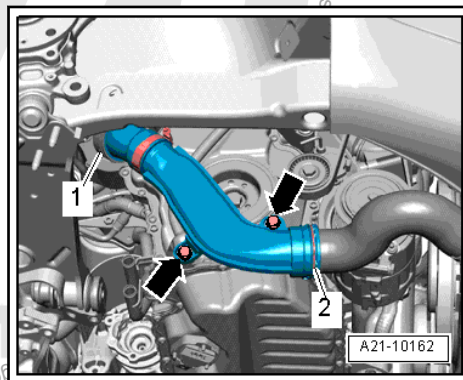
- ◆ Engine Support Bridge -10-222A-
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13- (quantity: 2)
- ◆ Locking Pin -T10060A-
- ◆ Bits for VAG1331/13 -T10099-



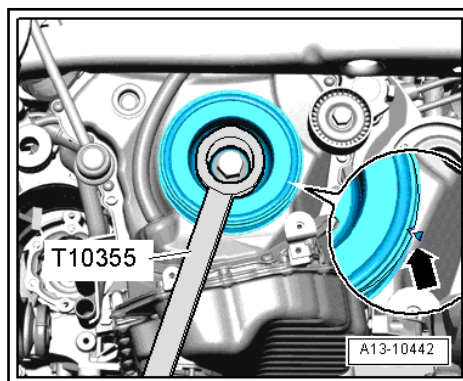
- ◆ Counterhold - Vibration Damper -T10355-
- ◆ Press Piece - Timing Chain Cover -T10368-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Silicone Sealant -D 174 003 A3-
- ◆ Flat scraper
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Feeler Gauge

### Removing

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove right front wheel.
- Remove the right front wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66; Wheel Housing Liner; Front Wheel Housing Liner, Removing and Installing.
- Drain the engine oil. Refer to ➤ Maintenance; Booklet 20.1.
- Remove the bolts .



- Remove the air guide pipe by lifting the clamps -1 and 2-.
- Remove the ribbed belt. Refer to ➤ [B5.3 elt](#), page 60 .
- Turn the vibration damper into "Top Dead Center (TDC)" -arrow- using the Counterhold - Vibration Damper - T10355A-.



- The notch on the vibration damper must align with the arrow marking on the lower timing chain cover.



**Caution**

*The engine could be destroyed:*

- ◆ *In order not to change the valve timing, the crankshaft must not be moved out of the "TDC" position when the vibration damper bolt is removed.*

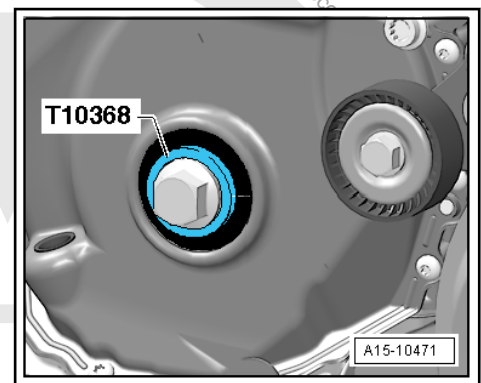
- Remove vibration damper bolt using the Counterhold - Vibration Damper -T10355A-.
- Remove the vibration damper.



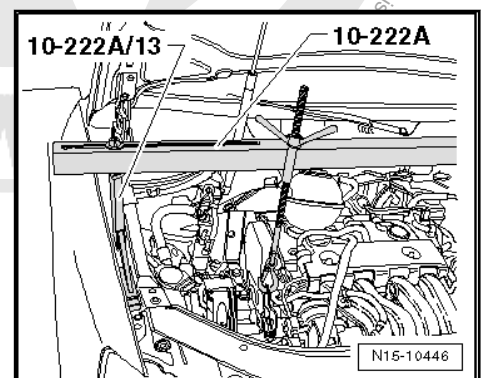
**Caution**

*To avoid damaging the splines, only install the vibration damper bolt with the Press Piece - Timing Chain Cover -T10368-.*

- Reinstall the vibration damper bolt and Press Piece - Timing Chain Cover -T10368-.



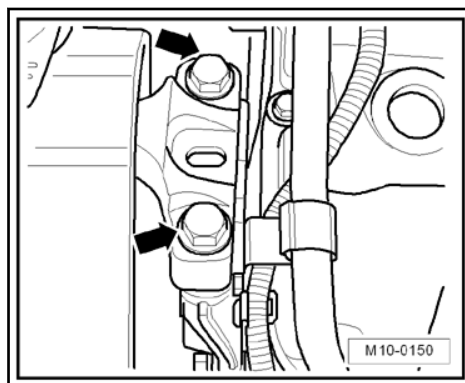
- If equipped, remove the charge air guide to the sound generator.
- Mount the Engine Support Bridge -10-222A- with the following tools:



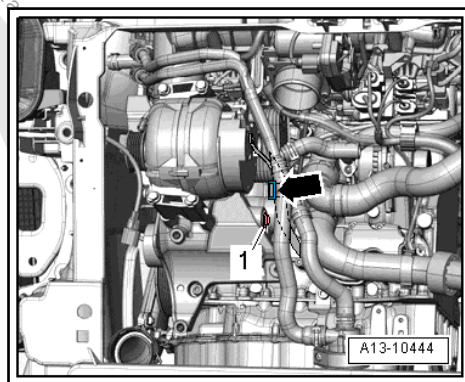
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13- (quantity: 2)
- Tension the engine with the spindle.



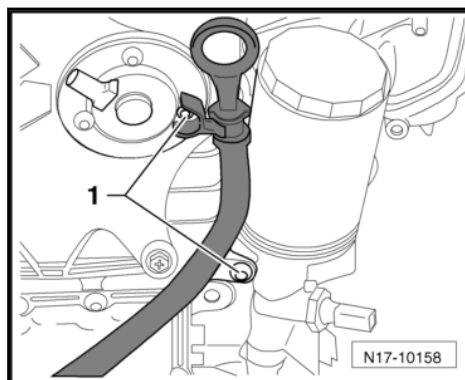
- Remove the subframe bolts -arrows- on the engine.



- Remove the engine mount. Refer to ➔ [-1.1 Subframe Mount](#), page 9.
- Lift the engine approximately 50 mm and loosen the upper bolt for the engine support.
- Now lower the engine approximately 100 mm.
- Free up the wiring harness -arrow-.

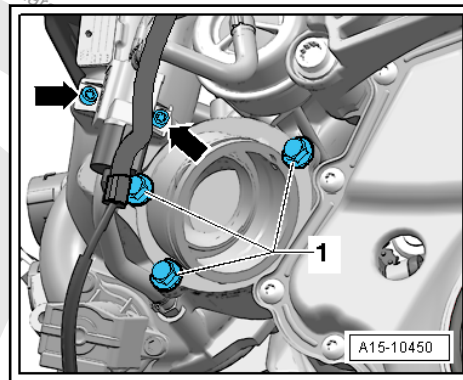


- Remove the bolt -1- and remove the ribbed belt tensioner from the accessory assembly bracket.
- Remove the lower engine support bolts using the Bits for VAG1331/13 -T10099-.
- Remove the engine support and the bolts.
- Remove the bolts -1- and pull the oil dipstick guide tube out of the lower timing chain cover.

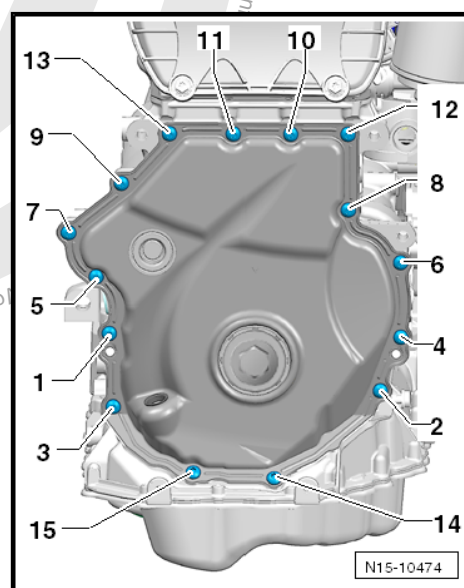


- Disconnect the Wastegate Bypass Regulator Valve -N75- from the turbocharger -arrows-.





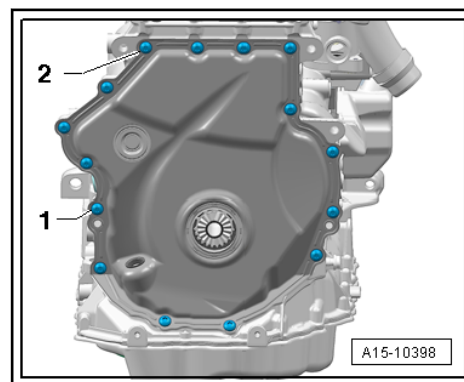
- Remove the turbocharger support -1-.
- Remove the bolts -1 through 15-.



#### Caution

*There is a risk of damaging the lower timing chain cover. To avoid deformation, do not hold between the bolting points.*

- Pry off the lower timing chain cover; when doing this, begin at -1 and 2-.







## Installing

- ◆ Lower timing chain cover bolt tightening sequence and specification. Refer to ➤ [Fig. "Lower Timing Chain Cover - Tightening Specifications and Tightening Sequence", page 105](#).
- ◆ Timing chain cover tightening specifications. Refer to ➤ [-1.4 Timing Chain Cover", page 103](#)
- ◆ Turbocharge tightening specifications. Refer to ➤ [-1.3 Turbocharger", page 350](#)
- ◆ Ribbed belt tightening specification. Refer to ➤ [-2.4 Ribbed Belt Drive", page 47](#)
- ◆ Subframe Mount tightening specifications. Refer to ➤ [-1.1 Subframe Mount", page 9](#)
- ◆ Use Silicone Sealant-D 174 003 A3-.



### Note

- ◆ *Sealing surfaces must be completely free of oil and grease.*
- ◆ *Note the expiration date of the Silicone Sealant.*
- ◆ *The cover must be installed within 5 minutes after applying Silicone Sealant.*
- ◆ *Replace the bolts which are being tightened with an additional turn.*
- ◆ *Replace sealing rings, seals and self-locking nuts.*

Remove any sealant residue on the cylinder block using a flat blade scraper.

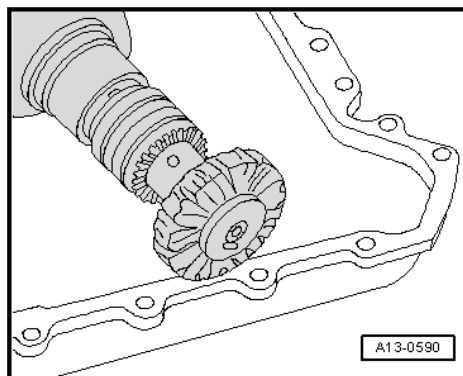


### WARNING

**Danger of eye injury.**

- ◆ **Wear protective eyewear.**

- Seal off both sides of the sealing ring with tape to prevent soiling.
- Remove residual sealant on the cover for example with a rotating plastic brush.



- Clean the sealing surfaces. They must be free of oil and grease.
- Install the cover with the old bolts and tighten:
  - Tightening specification: 8 Nm.

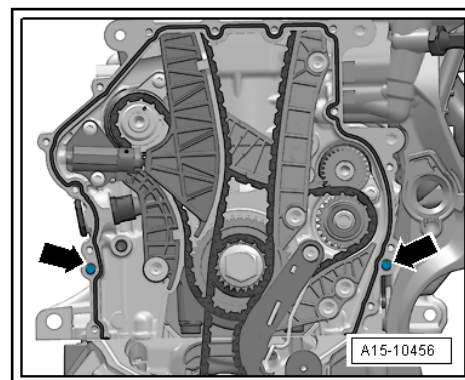


- Check the distance between the cover and housing using a feeler gauge.
- The distance must not exceed 0.2 mm.

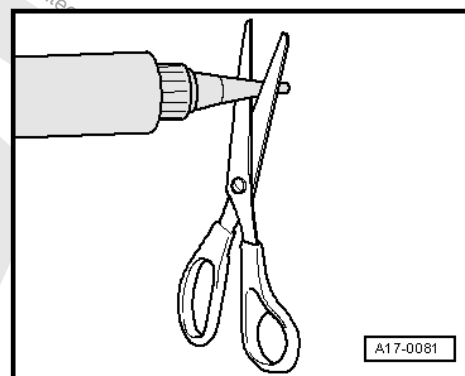


#### Note

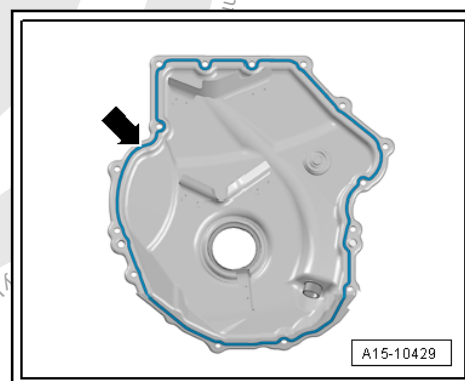
- ◆ *If the distance exceeds 0.2 mm, the cover needs to be replaced.*
- ◆ *It is not possible to measure between the cover the upper section of the oil pan, however check the sealing surface for evenness.*
- Make sure both alignment bushings for centering the cover -arrows- are present.



- Cut the tube nozzle at the front marking (nozzle diameter: approximately 3 mm).



- Apply Silicone Sealant on the clean sealing surface of the cover as shown.

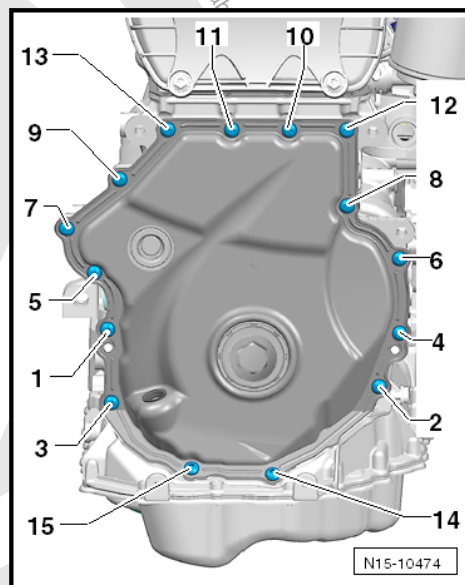


- Sealant bead thickness: 2 to 3 mm.



#### Note

- ◆ *The cover must be installed within five minutes after application of Silicone Sealant.*
- ◆ *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*
- ◆ *Pay attention to the expiration date of the sealant.*
- Install the cover immediately and tighten the new bolts:
- Tighten the bolts -1 through 15- in two stages in the sequence shown:



- 1 - Tighten the bolts to 8 Nm
- 2 - Turn the bolts an additional 45°



#### Note

*After installing cover, allow sealant to dry for approximately 30 minutes. Only after then may the engine oil be replenished.*

- Fill the engine oil. Refer to ⇒ Maintenance; Booklet 20.1.
- Check oil level. Refer to ⇒ [page 195](#) .

Further assembly is performed the reverse order of the removal.

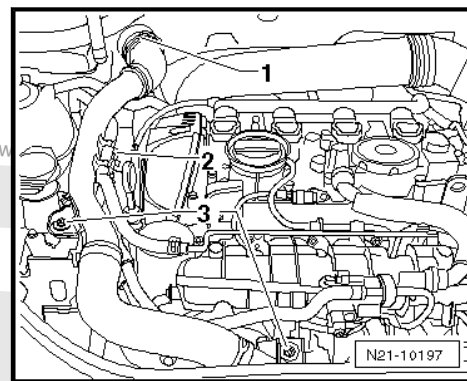
### 3.9 Upper Timing Chain Cover

#### Special tools and workshop equipment required

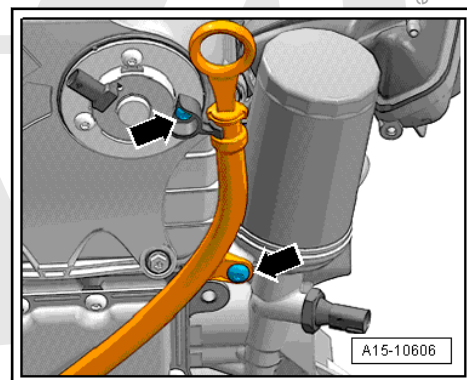
- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Torque Wrench 1783 - Open Jaw - 10mm -VAG1783/1-

#### Removing

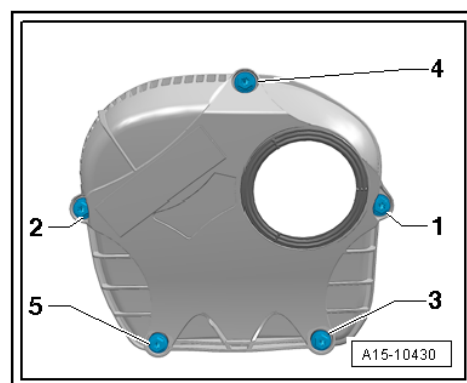
- Vehicles with sound generator: open the locking mechanism -1-, unclip the fuel lines -2- and loosen the bolt -3- on the Evaporative Emission (EVAP) canister. Move the charge air pipe aside.



- Press the coolant hoses to the side and secure them with a cable tie.
- Remove the bolts -arrows- and remove the oil dipstick tube from the timing chain cover.

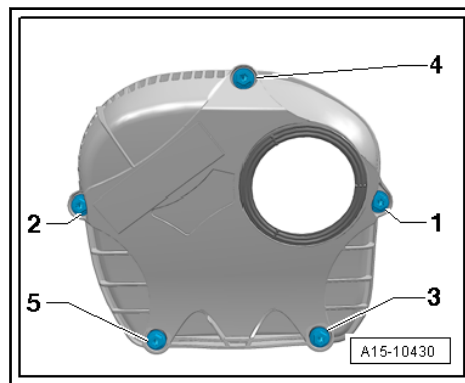


- Remove the Camshaft Adjustment Valve 1-N205-
- Remove the bolts -1 through 5- and remove the upper timing chain cover.



### Installing

- Coat the sealing ring and the O-ring with engine oil.
- Tighten the bolts -1 through 5- by hand in the illustrated sequence.



- Tighten the bolts to 9 Nm using the Torque Wrench 1783 - 2-10Nm -VAG1783- and Torque Wrench 1783 - Open Jaw - 10mm -VAG1783/1-.
- ♦ Tightening specifications. Refer to ➤ [-1.4 Timing Chain Cover](#), page 103.

Further assembly is performed the reverse order of the removal.

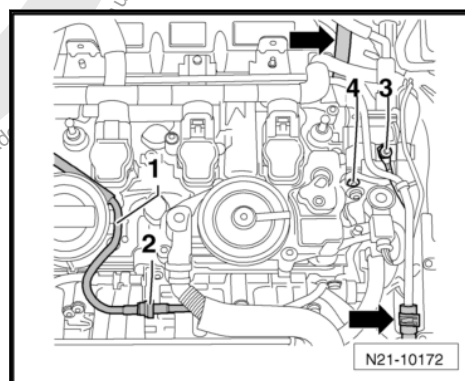
### 3.10 Vacuum Pump

#### Special tools and workshop equipment required

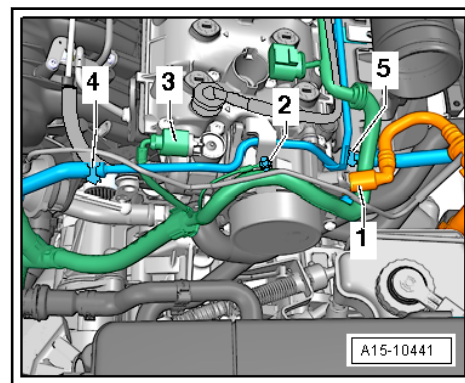
- ♦ Torque Wrench 1331 5-50Nm -VAG1331-

#### Removing

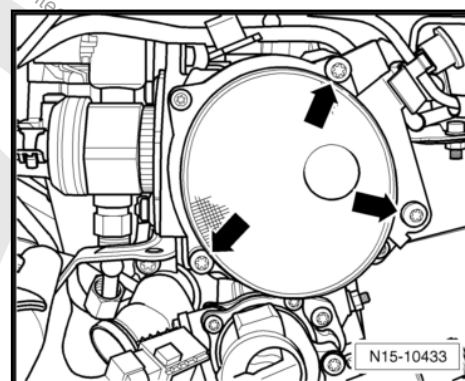
- Remove the engine cover. Refer to ➤ [C3.1 over](#), page 17.
- Remove the air filter. Refer to ➤ [F4.2 filter Housing](#), page 404.
- Remove the high pressure pump with the »roller tappet«. Refer to ➤ [P4.7 ressure Pump](#), page 418.
- Disconnect the Ground (GND) wire -3- and remove the bolt -4-.



- Remove the vacuum hose -1- from the vacuum pump.



- Remove the bolts -arrows- and remove the vacuum pump.



#### Note

*Do not disassemble the vacuum pump.*

#### Installing

Tightening specifications. Refer to ➔ [-1.3 Cylinder Head](#), page [98](#).

- Clean the sealing surfaces.
- Install the seal on the vacuum pump, install the two bolts and then mount it on the cylinder head.

The rest of the assembly is performed in the reverse order of removal.

### 3.11 Valve Stem Seals

#### Special tools and workshop equipment required

- ◆ Spark Plug Removal Tool -3122B-
- ◆ Puller - Valve Seal -3364-
- ◆ Seal Installer - Valve Stem -3365-
- ◆ Valve Cotter Tool Kit - Adapter -T40012-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Valve Keeper Tool Kit -VAS5161A-
- ◆ Valve Cotter Tool Kit - Guide Plate 19B -VAS5161/19B-

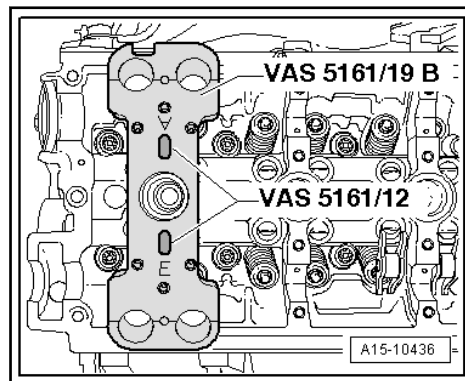
#### Removing

- Remove the camshafts. Refer to ➔ [3.2](#), page [118](#).

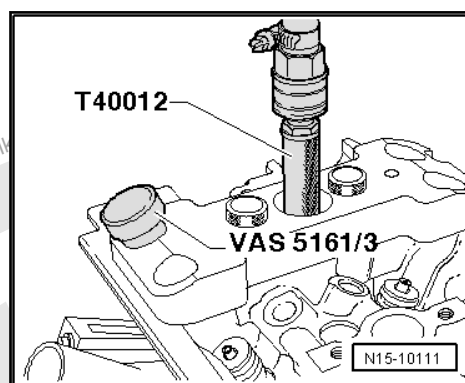




- Remove roller rocker levers and place them on a clean surface. While doing this, make sure that roller rocker levers are not interchanged.
- Remove the Spark Plugs using the Spark Plug Removal Tool -3122B-.
- Fasten the Valve Cotter Tool Kit - Guide Plate 19c - VAS5161/19C- with the Valve Cotter Tool Kit - Knurled Thumb Screws M6 -VAS5161/12- onto the cylinder head as shown.

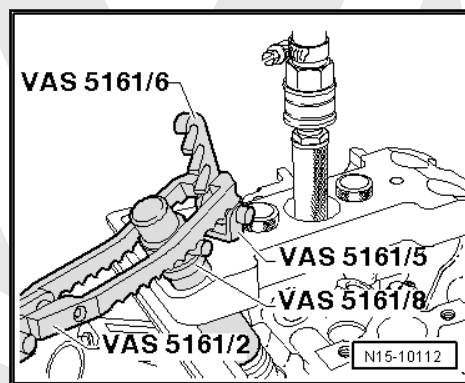


- Adjust the piston of the respective cylinder to “Bottom Dead Center (BDC)”.
- Install the Valve Cotter Tool Kit - Adapter -T40012- into the spark plug thread and connect the compressed air of at least 6 bar (87 psi) pressure.



- Loosen the secure fitting valve keepers using the Valve Cotter Tool Kit - Punch -VAS5161/3A- and a plastic mallet.

#### For Intake Side

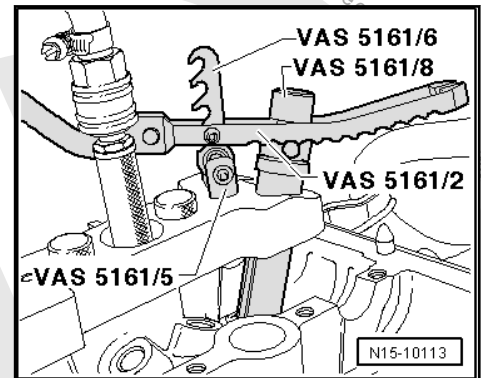


- Install the Valve Cotter Tool Kit - Retainer -VAS5161/6- with the Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded

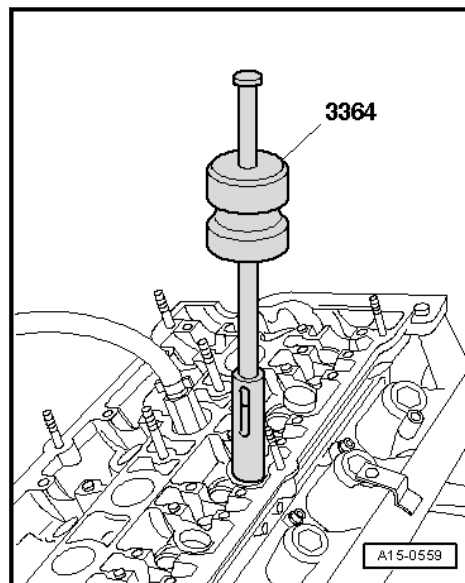


- VAS5161/5- in the center thread of the Valve Cotter Tool Kit  
- Guide Plate 19c - VAS5161/19C-.
- Place the Valve Cotter Tool Kit - Assembly Cartridge -  
VAS5161/8A- in the Valve Cotter Tool Kit - Guide Plate 19c  
-VAS5161/19C-.
- Engage the Valve Cotter Tool Kit - Pressure Fork with Lever  
for Assembly Cartridge -VAS5161/2- on the Valve Cotter  
Tool Kit - Retainer -VAS5161/6-.

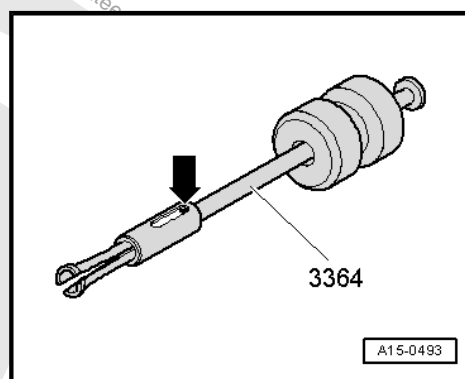
#### For Exhaust Side



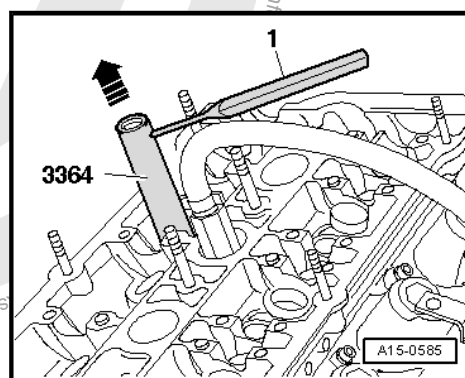
- Install the Valve Cotter Tool Kit - Retainer -VAS5161/6- with  
the Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded  
-VAS5161/5- in the outer threads of the Valve Cotter Tool Kit  
- Guide Plate 19c - VAS5161/19C-.
- Press the Valve Cotter Tool Kit - Assembly Cartridge -  
VAS5161/8A- downward. At the same time, turn the knurled  
screw of the Valve Cotter Tool Kit - Assembly Cartridge  
-VAS5161/8A- to the right, until the points engage in the  
valve retainers.
- Lightly move knurled bolt back and forth, causing the valve  
retainers to be pressed apart and be captured in the installa-  
tion cartridge.
- Release the Valve Cotter Tool Kit - Pressure Fork with Lever  
for Assembly Cartridge -VAS5161/2-.
- Remove the Valve Cotter Tool Kit - Assembly Cartridge  
-VAS5161/8A-.
- Remove the valve stem seals using Puller - Valve Seal  
-3364-.



- If the Puller - Valve Seal -3364- cannot be used due to restricted clearance, drive the spring pin -arrow- out with a drift and remove the impact attachment.



- Place the lower part of the Puller - Valve Seal -3364- onto the valve stem seal.



- Install a drift -1- into the hole into the lower part of the puller.
- Place a lever at the puller and pull out the valve stem seal in direction of -arrow-.

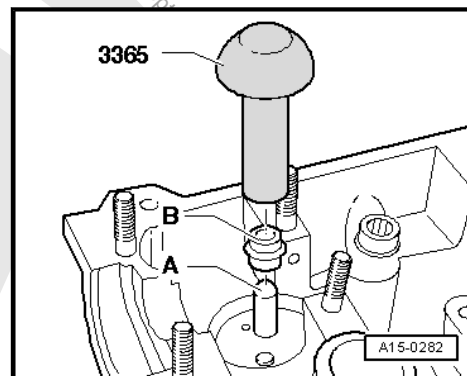
### Installing

- Place plastic sleeve -A- on the valve stem to prevent damage to the new valve stem seals -B-.



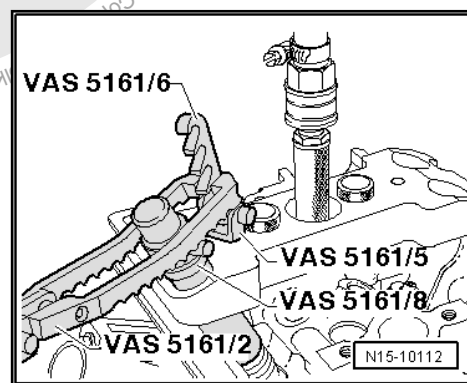
- Oil the sealing lip of valve stem seal -B-, insert into Seal Installer - Valve Stem -3365- and carefully slide onto the valve guide.
- Remove the plastic sleeve -A-.
- Insert valve spring and valve spring retainer.

#### For Intake Side

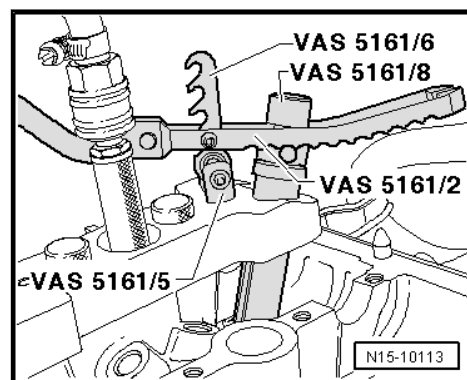


- Install the Valve Cotter Tool Kit -VAS5161A- as shown.

#### For Exhaust Side



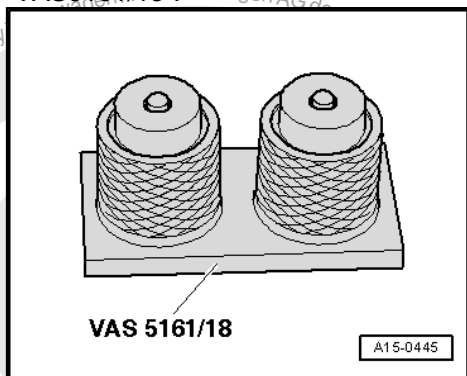
- Install the Valve Cotter Tool Kit -VAS5161A- as shown.





## Note

*If the valve retainers were removed from the installation cartridge, they must then be inserted into the Valve Cotter Tool Kit - Valve Insertion Device - VAS5161/18.*



*Press the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8A- onto the insertion device from above and capture the valve retainers.*

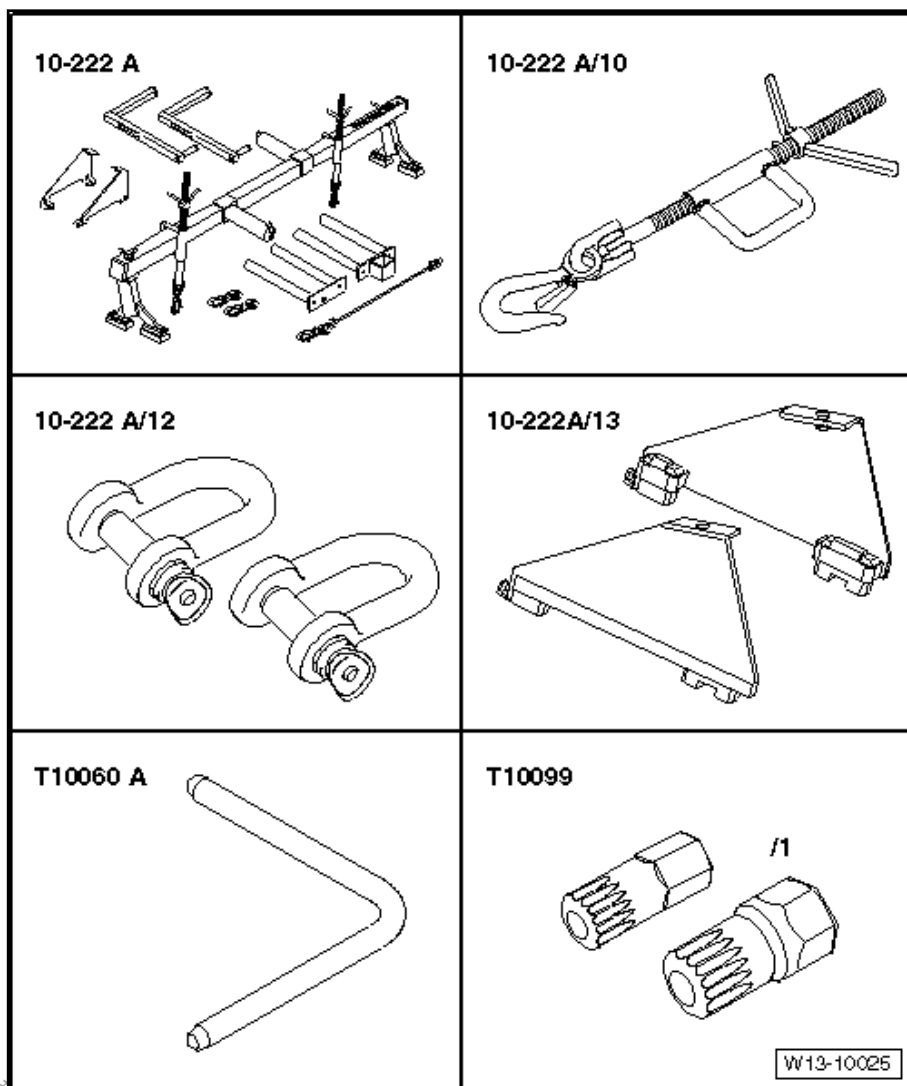
- Press the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8A- downward with the Valve Cotter Tool Kit - Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- and turn the assembly cartridge knurled screw back and forth while pulling it upward at the same time.
- Release the Valve Cotter Tool Kit - Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- with the knurled screw pulled.
- Remove the Valve Cotter Tool Kit - VAS5161A-.
- Install the Spark Plugs. Refer to ➤ [-2.1 Ignition System](#), [page 454](#) .
- Install the Ignition Coil with Power Output Stage. Refer to ➤ [C4.2 coils with Power Output Stages](#), [page 459](#) .

Further assembly is performed the reverse order of the removal.



## 4 Special Tools

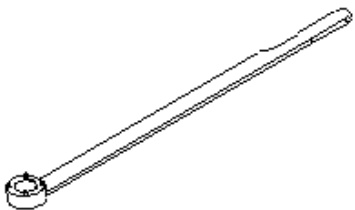
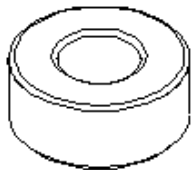

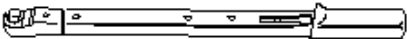
Special tools and workshop equipment required



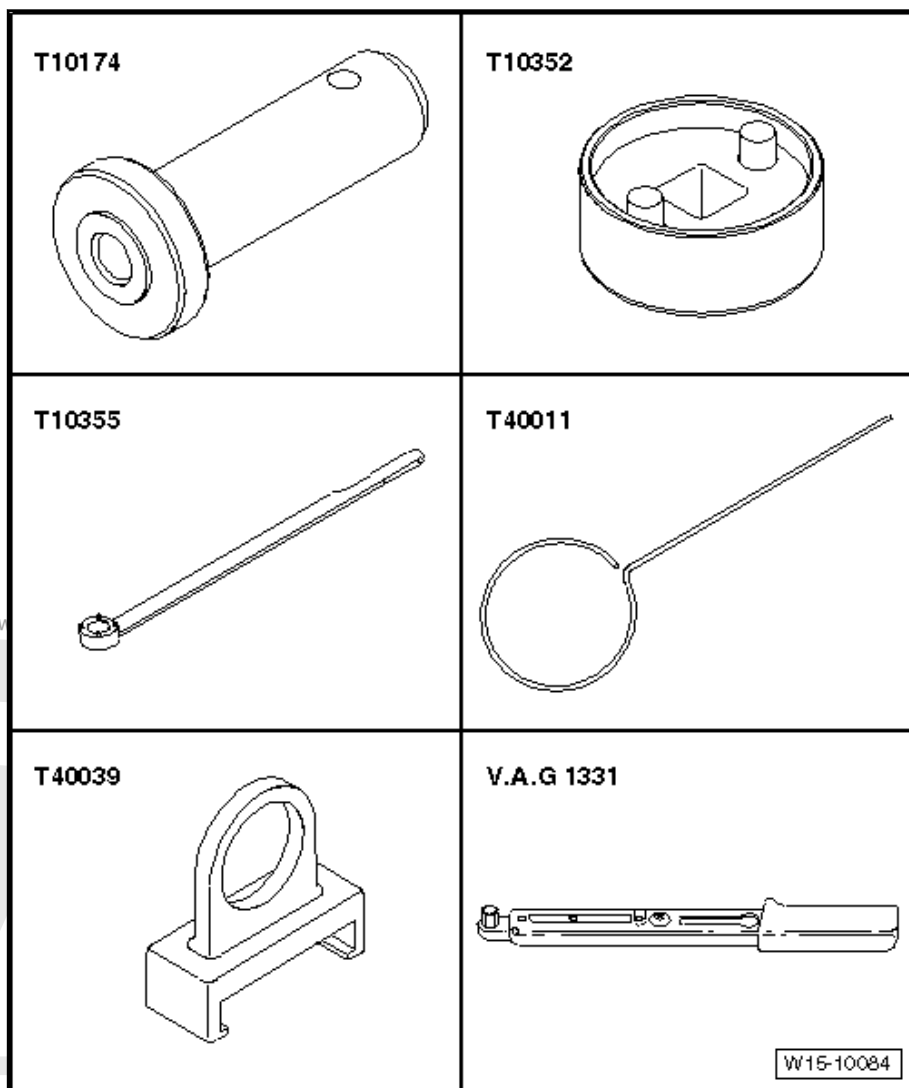
- ◆ Engine Support Bridge -10-222A-
- ◆ Engine Support - Bracket w/Spindle and hook -10-222A/10-
- ◆ Engine/Gearbox Support Shackle (2 pc.) -10-222A/12-
- ◆ Engine Support Bridge - Gearbox Adapter -10-222A/13-  
(quantity: 2)
- ◆ Locking Pin -T10060A-
- ◆ Bits for VAG1331/13 -T10099-





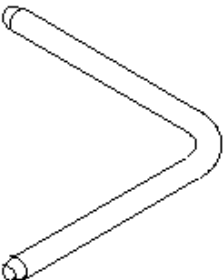
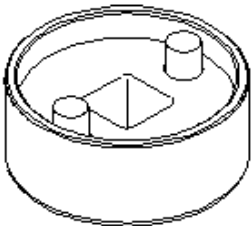
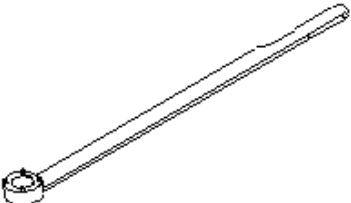
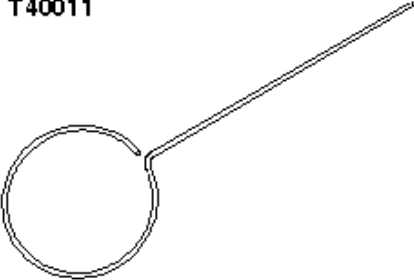

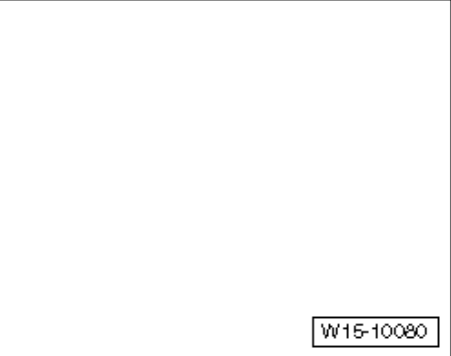
<b>T10355</b> 	<b>T10368</b> 
<b>V.A.G 1331</b> 	<b>V.A.G 1332</b> 
	<b>W13-10026</b>

- ◆ Counterhold - Vibration Damper -T10355-
- ◆ Press Piece - Timing Chain Cover -T10368-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Silicone Sealant -D 174 003 A3-

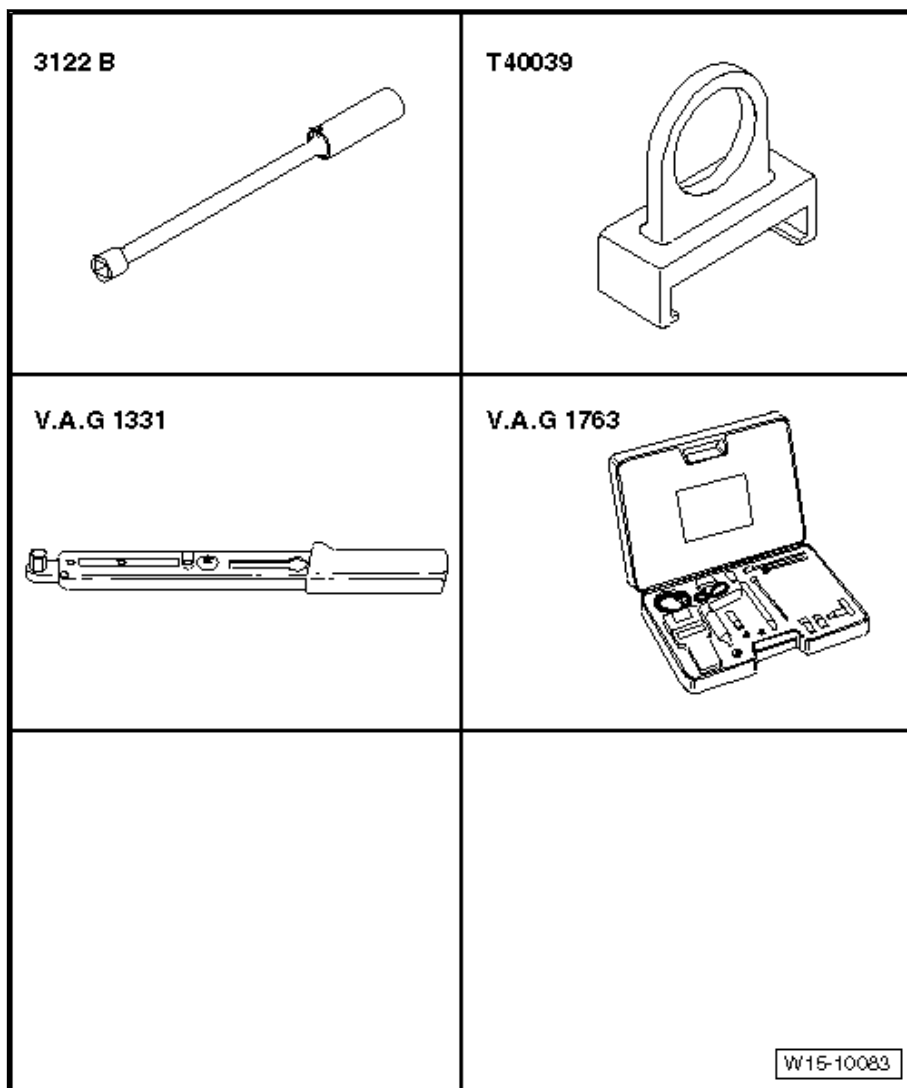


- ◆ Seal Installer - Selector Shaft Oil Seal -T10174-
- ◆ Central Valve Assembly Tool -T10352- (Engine code CCZA: Central Valve Assembly Tool -T10352/1-)
- ◆ Counterhold - Vibration Damper -T10355-
- ◆ Locking Pin (3 pc.) -T40011-
- ◆ Puller - Ignition Coil -T40039-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Silicone Sealant -D 154 103 A1-
- ◆ Cable Tie

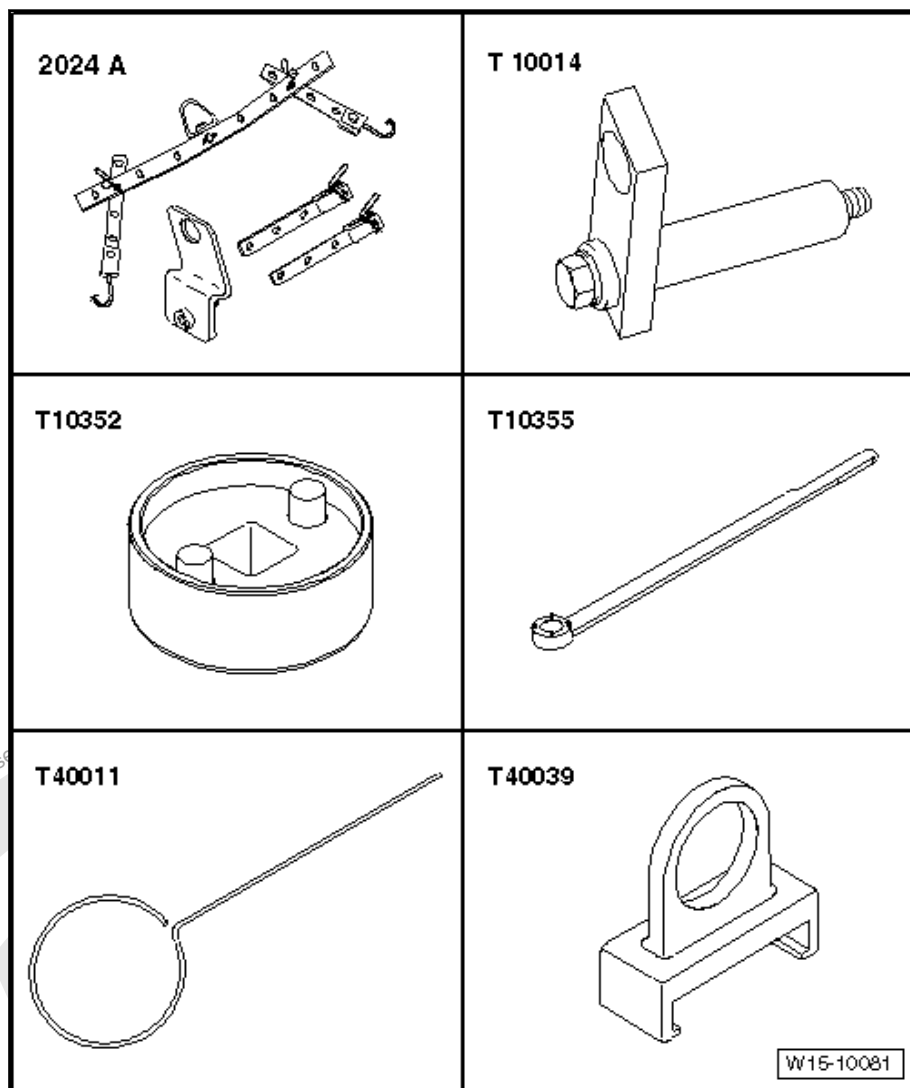


<b>T10060 A</b> 	<b>T10352</b> 
<b>T10355</b> 	<b>T40011</b> 
<b>V.A.G 1331</b> 	 <div>W15-10080</div>

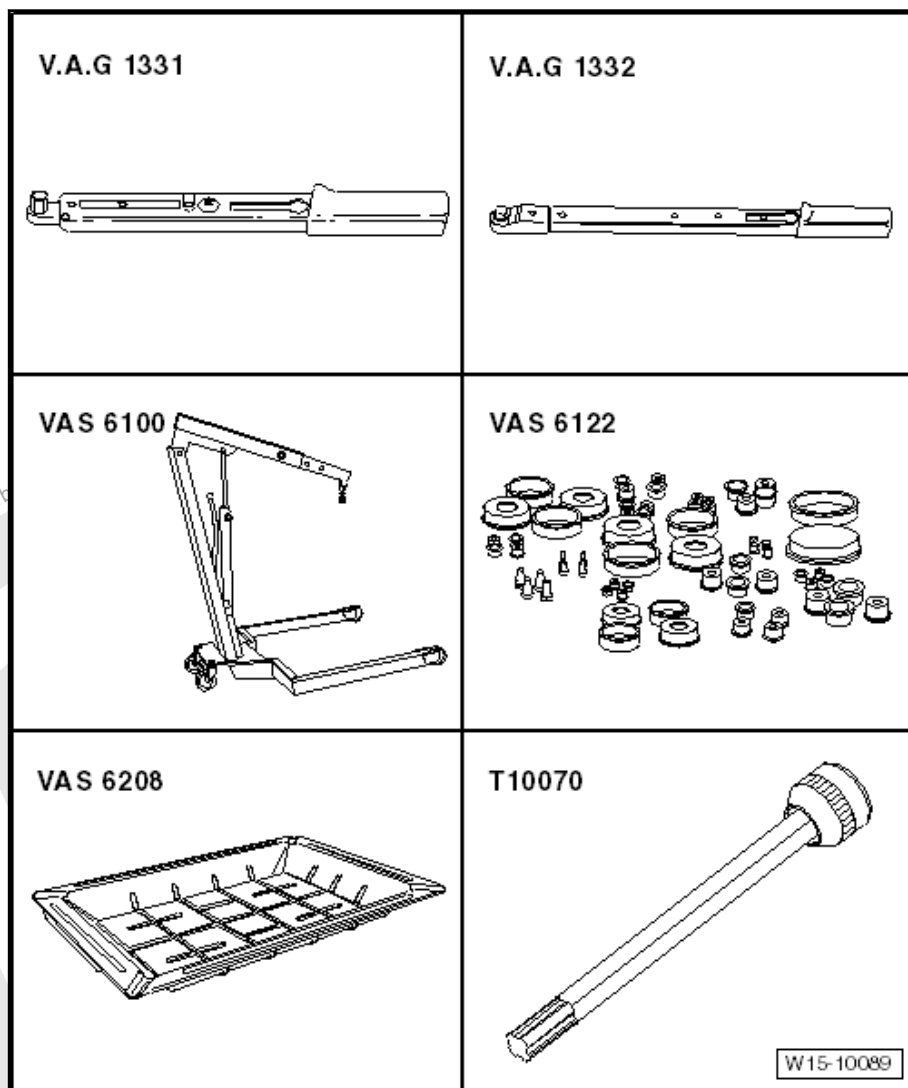
- ◆ Locking Pin -T10060A-
- ◆ Central Valve Assembly Tool -T10352-
- ◆ Counterhold - Vibration Damper -T10355-
- ◆ Locking Pin (3 pc.) -T40011-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-



- ◆ Spark Plug Removal Tool -3122B-
- ◆ Puller - Ignition Coil -T40039-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Compression Tester Kit -VAG1763- with Compression Tester Kit - Adapter 6 -VAG1763/6-

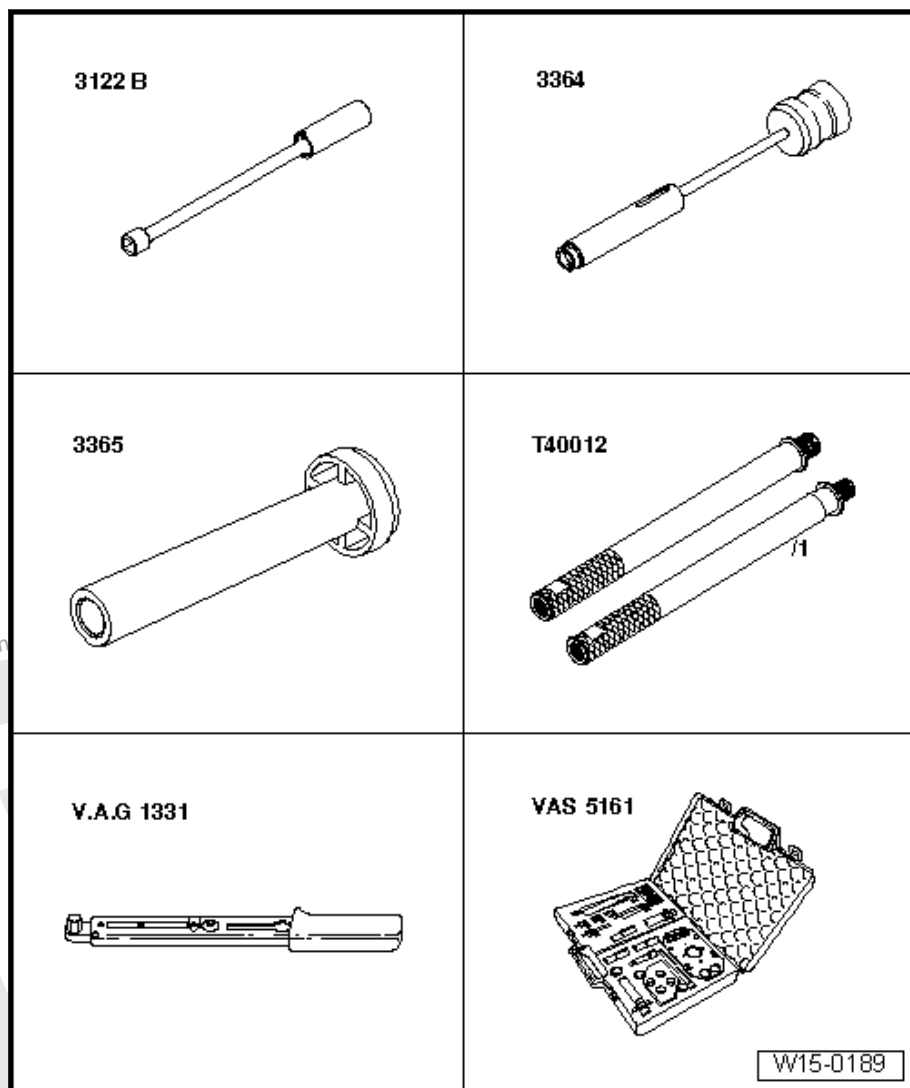


- ◆ Engine Sling -2024A-
- ◆ Engine Support -T10014-
- ◆ Central Valve Assembly Tool -T10352- (Engine code CCZA:  
Central Valve Assembly Tool -T10352/1-)
- ◆ Counterhold Vibration Damper -T10355-
- ◆ Locking Pin (3 pc.) -T40011-
- ◆ Puller - Ignition Coil -T40039-



- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Shop Crane -VAS6100-
- ◆ Engine Bung Set -VAS6122-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Polydrive Bit Drive Socket -T10070-
- ◆ Cable Tie

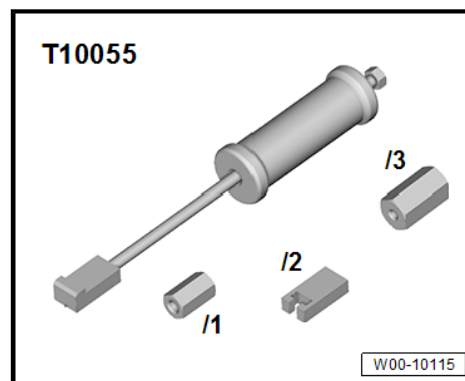




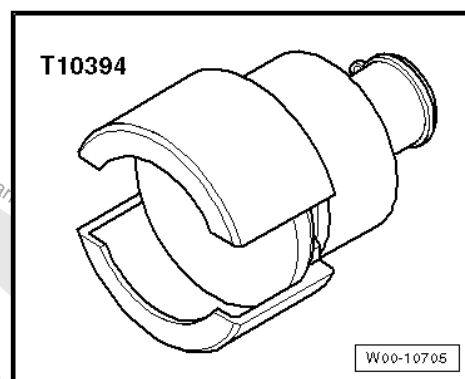
- ◆ Spark Plug Removal Tool -3122B-
- ◆ Puller - Valve Seal -3364-
- ◆ Seal Installer - Valve Stem -3365-
- ◆ Valve Cotter Tool Kit - Adapter -T40012-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Valve Keeper Tool Kit -VAS5161A-
- ◆ Valve Cotter Tool Kit - Guide Plate 19B -VAS5161/19B-



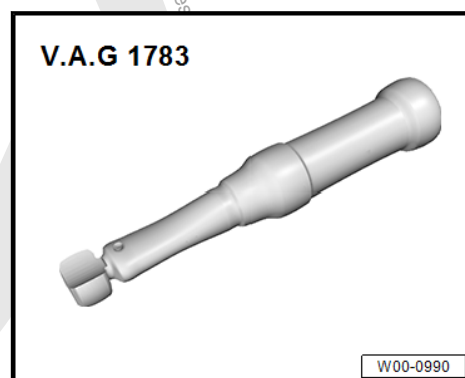
◆ Puller - Unit Injector -T10055-



◆ Puller - Balancer Shaft -T10394-



◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

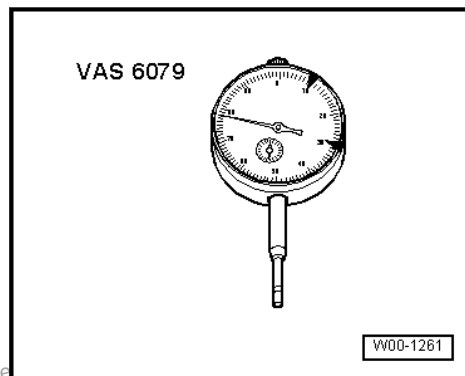


◆ Torque Wrench 1783 - Open Jaw - 10mm -VAG1783/1-

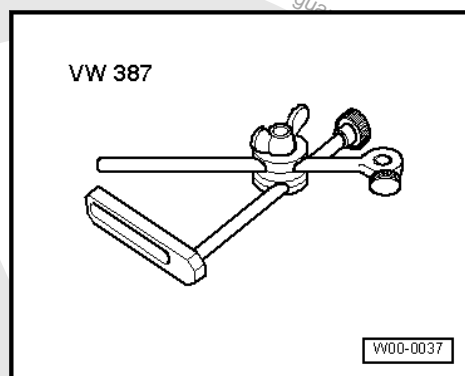




- ◆ Dial Gauge - 0-10mm -VAS6079-



- ◆ Dial Gauge Holder -VW387-



- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Torque Wrench 1783 - Open Jaw - 10mm -VAG1783/1-



## 17 – Lubrication

### 1 General Information

⇒ **O1.1 il"**, **page 195**

#### 1.1 Engine Oil



##### Note

- ♦ *The oil level must not go above the MAX mark - danger of causing damage to the catalytic converter! Oil Level, Checking. Refer to ⇒ **page 195**.*
- ♦ *If large quantities of metal shavings or abrasions are detected during engine repairs, it may mean the crankshaft or connecting rod bearings are damaged. To prevent further damage, perform the following steps after the repair:*

##### Oil Capacities

Refer to ⇒ Fluid Capacity Tables; Rep. Gr. 03

##### Engine Oil Specifications

Refer to ⇒ Fluid Capacity Tables; Rep. Gr. 03

##### Replacing Engine Oil

Refer to ⇒ Maintenance; Booklet 20.1

##### Oil Level, Checking



##### Note

*The oil level must not exceed the MAX marking - danger of damaging the catalytic converter!*

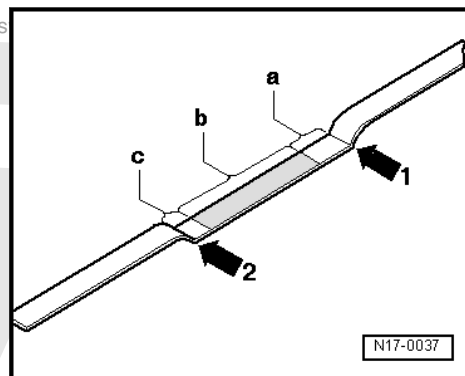
##### Test Conditions

- Engine oil temperature at least 60 °C (140 °F).
- The vehicle is on level ground.
- After stopping engine, wait a few minutes to allow oil to flow back into oil pan.

##### Test Sequence

- Pull out the oil dipstick, wipe off with a clean cloth and insert it all the way.
- Withdraw dipstick again and check the oil level.

Range of markings on dipstick:



- a - Oil must not be added.
- b - Oil may be added.
- c - Oil must be added.



**Note**

*Oil level must not exceed max. marking -arrow 1- and must not fall short of min. marking -arrow 2-.*



## 2 Description and Operation

⇒ [-2.1 Oil Pan/Oil Pump", page 197](#)

⇒ [-2.2 Oil Filter Housing/Oil Pressure Switch F1 ", page 201](#)

⇒ [-2.3 Oil Filter Housing/Oil Pressure Switch F22 and Reduced Oil Pressure Switch F378 ", page 203](#)

### 2.1 Overview - Oil Pan/Oil Pump







# 1 - Oil Level Thermal Sensor -G266-

- ☐ Engine codes CAWB and CCZA only

# 2 - Seal

- ☐ Always replace
- ☐ Engine codes CAWB and CCZA only

# 3 - Bolt

- ☐ Always replace
- ☐ Tightening Sequence and Specification ➤ [Fig. "Lower Oil Pan Section, Tightening Sequence and Tightening Specification", page 199](#).

# 4 - Oil Pan Lower Section

- ☐ Removing and installing. Refer to ➤ [P4.2 an Lower Section", page 212](#).

# 5 - Bolt

- ☐ 9 Nm

# 6 - Oil Baffle

- ☐ Always replace

# 7 - Oil Pump Bolts

- ☐ M 6: 9 Nm
- ☐ M 8: 20 Nm

# 8 - Oil Pump

- ☐ Removing and installing. Refer to ➤ [P4.6 ump", page 221](#).

- ☐ Oil Pressure and Oil Pressure Switch, Checking

- ♦ Engine codes CAWB, CBFA and CCTA: ➤ [P3.1 ressure and Oil Pressure Switch F1, Checking", page 206](#)

- ♦ Engine code CCZA: ➤ [P3.2 ressure and Reduced Oil Pressure SwitchF378, Checking", page 207](#)

# 9 - Alignment Sleeve

- ☐ For centering the oil pump

# 10 - Chain Tensioner

- ☐ For the oil pump drive chain

# 11 - Bolt

- ☐ 9 Nm

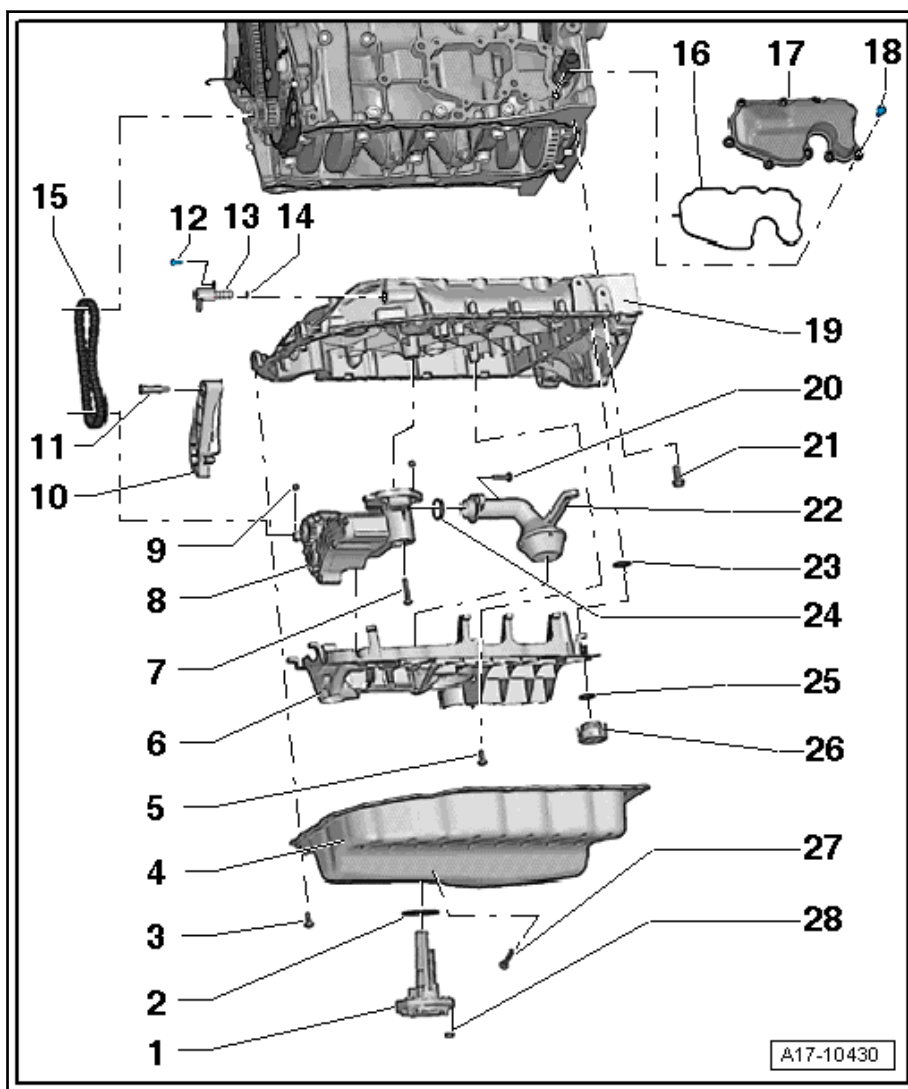
# 12 - Bolt

- ☐ 9 Nm
- ☐ Engine code CCZA only

# 13 - Oil Pressure Regulation Valve -N428-

- ☐ Engine code CCZA only
- ☐ Removing and installing. Refer to ➤ [O4.4 il Pressure Regulation Valve N428 ", page 219](#).

# 14 - O-Ring





- ☐ Engine code CCZA only
- ☐ Always replace

#### 15 - Drive Chain

- ☐ For the oil pump
- ☐ Mark direction of rotation before removing

#### 16 - Seal

- ☐ Always replace

#### 17 - Oil Separator

- ☐ Removing and installing. Refer to [⇒ S4.7 eparator", page 223](#) .

#### 18 - Bolt

- ☐ Tightening Sequence and Specification. Refer to [⇒ S4.7 eparator", page 223](#) .

#### 19 - Oil Pan Upper Section

- ☐ Removing and installing. Refer to [⇒ P4.3 an Upper Section", page 215](#) .

#### 20 - Bolt

- ☐ 9 Nm

#### 21 - Bolt

- ☐ Tightening sequence and tightening specification

- ◆ Engine codes CAWB, CBFA and CCTA: [⇒ Fig. ""Oil Pan Upper Section - Tightening Sequence and Tightening Specification, Engine Codes CAWB, CBFA, CCTA"" , page 200](#)

- ◆ Engine code CCZA: [⇒ Fig. ""Upper Oil Pan Section, Tightening Sequence and Tightening Specification, Engine Code CCZA"" , page 200](#)

- ☐ Always replace

#### 22 - Oil Intake Pipe

- ☐ Clean the screen if it is dirty.

#### 23 - Seal

- ☐ Always replace
- ☐ In oil baffle; -item 6- [⇒ Item 6 \(page 198\)](#) mounted permanently

#### 24 - O-Ring

- ☐ Always replace

#### 25 - O-Ring

- ☐ No replacement part, part of the check valve delivery package

#### 26 - Check Valve

- ☐ Always replace
- ☐ clipped into oil baffle -item 6- [⇒ Item 6 \(page 198\)](#) .

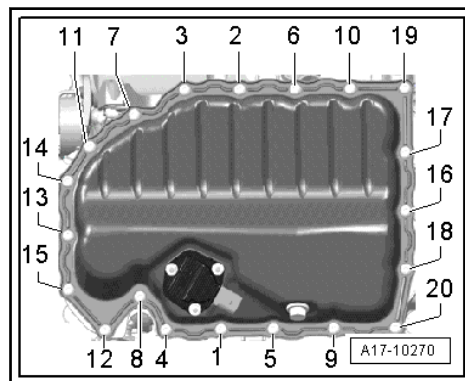
#### 27 - Oil Drain Plug

- ☐ 30 Nm
- ☐ Always replace
- ☐ With permanent sealing ring

#### 28 - Nut

- ☐ 9 Nm
- ☐ Engine codes CAWB and CCZA only

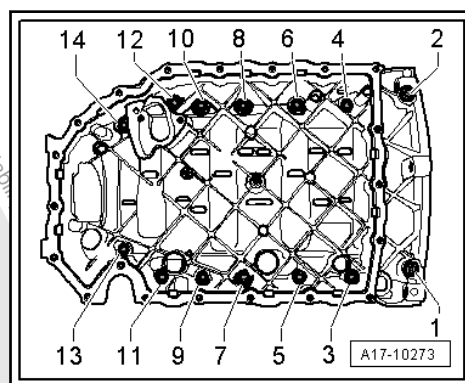
### Lower Oil Pan Section, Tightening Sequence and Tightening Specification



– Tighten new bolts in 3 stages in a -1 to 20- sequence as follows:

- 1 - Tighten Bolts Hand-Tight.
- 2 - Tighten the Bolts to 8 Nm.
- 3 - Turn the Bolts an additional 45°.

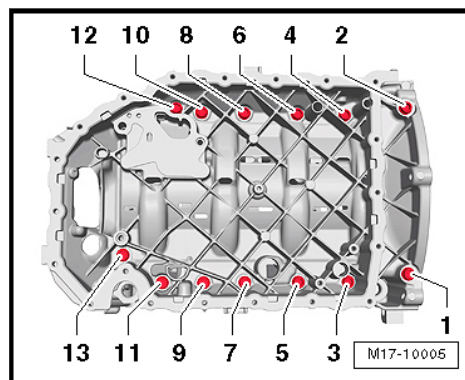
#### Oil Pan Upper Section - Tightening Sequence and Tightening Specification, Engine Codes CAWB, CBFA, CCTA



– Tighten new bolts in 3 stages in the sequence -1 to 14- as follows:

- 1 - Tighten Bolts Hand-Tight.
- 2 - Tighten the Bolts to 15 Nm.
- 3 - Tighten the Bolts an Additional 90°.

#### Upper Oil Pan Section, Tightening Sequence and Tightening Specification, Engine Code CCZA



– Tighten new bolts in 3 stages in the sequence -1 to 12- as follows:



- 1 - Tighten Bolts Hand-Tight.
- 2 - Tighten the Bolts to 15 Nm.
- 3 - Tighten the Bolts an Additional 90°.

## 2.2 Overview - Oil Filter Housing/Oil Pressure Switch -F1-





### 1 - Sub-Assembly Bracket

- ❑ Removing and installing. Refer to ➤ [B5.8 racket", page 76](#) .

### 2 - Oil Pressure Switch -F1-

- ❑ 20 Nm
- ❑ 1.4 bar (20.30 psi) - black
- ❑ Checking. Refer to ➤ [P3.1 ressure and Oil Pressure Switch F1, Checking", page 206](#) .
- ❑ Remove using the Socket and Jointed Extension - 24mm - T40175-

### 3 - Seal

- ❑ Always replace

### 4 - O-Ring

- ❑ No replacement part, part of the valve unit delivery package

### 5 - O-Ring

- ❑ No replacement part, part of the valve unit delivery package

### 6 - Valve Unit

- ❑ With O-rings

### 7 - Oil Filter

- ❑ 22 Nm
- ❑ Observe the notes. Refer to ➤ [page 195](#) .
- ❑ Removing and installing. Refer to ➤ Maintenance; Booklet 20.1
- ❑ Remove and install using the Wrench - Oil Filter -3417-

### 8 - Bolt

- ❑ 15 Nm

### 9 - Connection

### 10 - Gasket

- ❑ Always replace

### 11 - Engine Oil Cooler

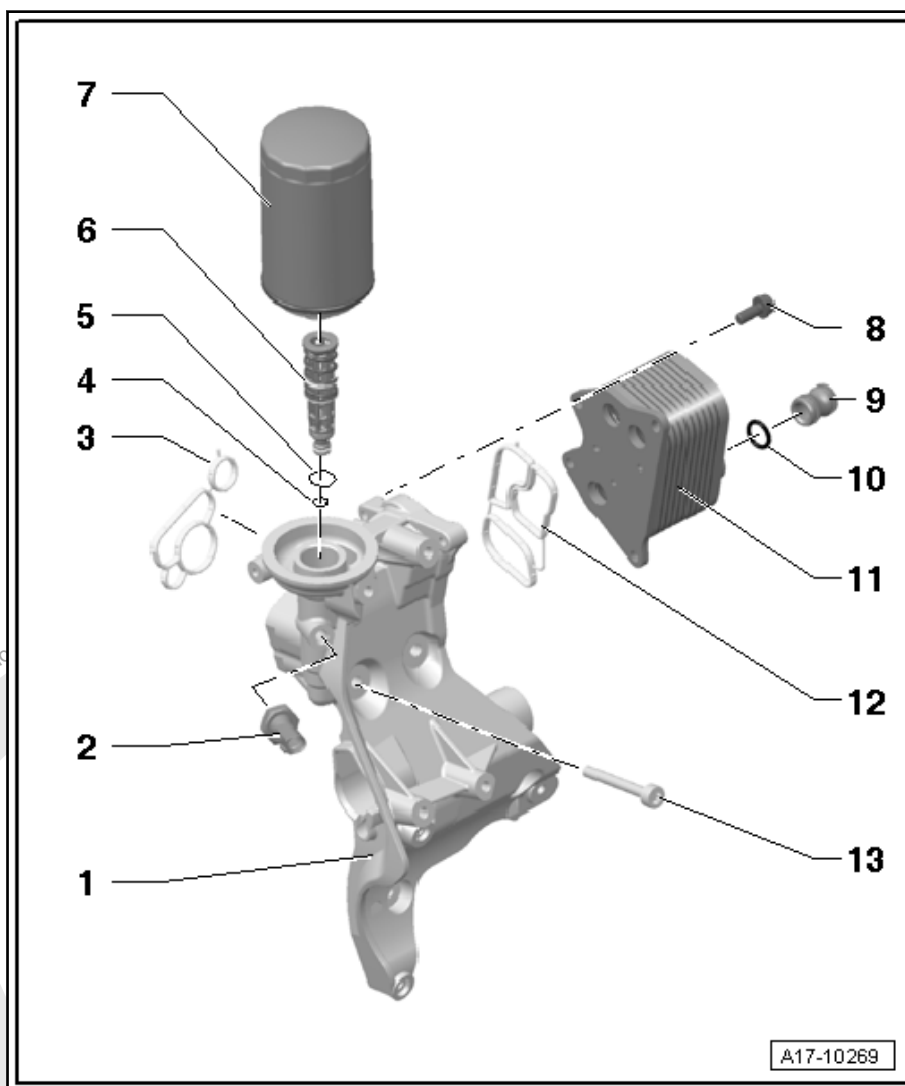
- ❑ Observe the notes. Refer to ➤ [page 195](#) .
- ❑ Make sure there is enough space to the surrounding components
- ❑ Removing and installing. Refer to ➤ [O4.1 il Cooler", page 211](#) .
- ❑ Coolant hose connection diagram. Refer to ➤ [D2.1 iagram - Coolant Hoses", page 235](#) .

### 12 - Seal

- ❑ Always replace

### 13 - Bolt

- ❑ Tightening sequence and specification. Refer to ➤ [Fig. ""Accessory Assembly Bracket - Tightening Sequence and Tightening Specification""", page 49](#) .





## 2.3 Overview - Oil Filter Housing/Oil Pressure Switch -F22- and Reduced Oil Pressure Switch -F378-







### 1 - Sub-Assembly Bracket

- ❑ Removing and installing. Refer to ➤ [B5.8 racket", page 76](#) .

### 2 - Oil Pressure Switch -F22-

- ❑ 20 Nm
- ❑ Blue insulation
- ❑ Removing and installing. Refer to ➤ [O4.5 il Pressure Switch F22", page 220](#) .
- ❑ Checking. Refer to ➤ [P3.2 ressure and Reduced Oil Pressure SwitchF378, Checking", page 207](#) .

### 3 - Reduced Oil Pressure Switch -F378-

- ❑ 20 Nm
- ❑ Brown insulation
- ❑ Removing and installing. Refer to ➤ [R4.8 educed Oil Pressure Switch F378", page 224](#) .
- ❑ Checking. Refer to ➤ [P3.2 ressure and Reduced Oil Pressure SwitchF378, Checking", page 207](#) .

### 4 - Seal

- ❑ Always replace

### 5 - O-Ring

- ❑ No replacement part, part of the valve unit delivery package

### 6 - O-Ring

- ❑ No replacement part, part of the valve unit delivery package

### 7 - Valve Unit

- ❑ With O-rings

### 8 - Oil Filter

- ❑ 22 Nm
- ❑ Observe the notes. Refer to ➤ [page 195](#) .
- ❑ Removing and installing. Refer to ➤ Maintenance; Booklet 20.1
- ❑ Remove and install using the Wrench - Oil Filter -3417-

### 9 - Bolt

- ❑ 15 Nm

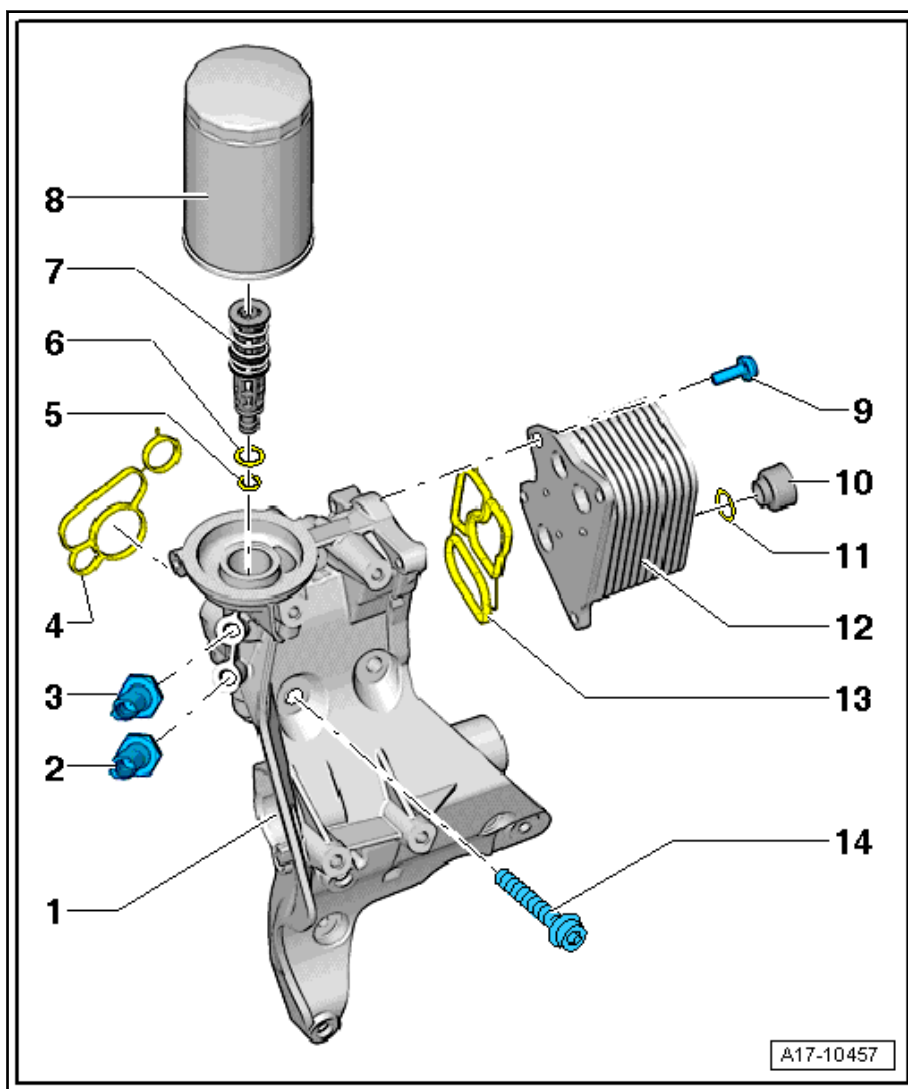
### 10 - Connection

### 11 - Gasket

- ❑ Always replace

### 12 - Engine Oil Cooler

- ❑ Observe the notes. Refer to ➤ [page 195](#) .
- ❑ Make sure there is enough space to the surrounding components





- ☐ Removing and installing. Refer to ⇒ [O4.1 il Cooler", page 211](#) .
- ☐ Coolant hose connection diagram. Refer to ⇒ [D2.1 iagram - Coolant Hoses", page 235](#) .

### 13 - Seal

- ☐ Always replace

### 14 - Bolt

- ☐ Tightening sequence. Refer to ⇒ [Fig. ""Accessory Assembly Bracket - Tightening Sequence and Tightening Specification"" page 49](#)
- ☐ Always replace



### 3 Diagnosis and Testing

⇒ [P3.1 ressure and Oil Pressure Switch F1, Checking", page 206](#)

⇒ [P3.2 ressure and Reduced Oil Pressure SwitchF378, Checking", page 207](#)

#### 3.1 Oil Pressure and Oil Pressure Switch -F1-, Checking

##### Special tools and workshop equipment required

- ◆ Oil Pressure Gauge Kit -VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set -VAG1594D-
- ◆ Socket and Jointed Extension - 24mm -T40175-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Vehicle Diagnostic Tester

##### Test Conditions

- Engine oil level OK, checking. Refer to ⇒ [page 195](#) .
- The engine oil temperature is at least 80 °C (176 °F) (the Radiator Fan must start up once).

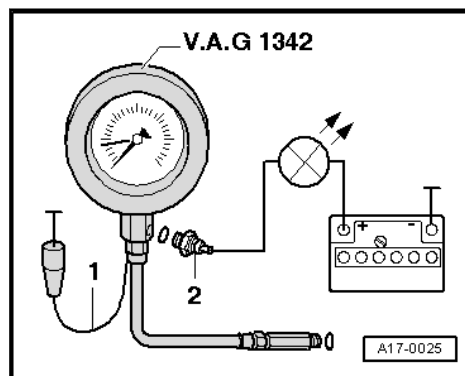


##### Note

*For the function test and servicing of the optical and acoustic oil pressure warning: Refer to ⇒ [Wiring diagrams, Troubleshooting & Component locations and the Vehicle Diagnostic Tester "Function and Component Selection"](#).*

##### Test Sequence

- ◆ Tightening specification. Refer to ⇒ [-2.2 Oil Filter Housing/Oil Pressure SwitchF1", page 201](#) .
- Disconnect the connector from the Oil Pressure Switch -F1-
- Remove the Oil Pressure Switch - F1- -2- using the Socket and Jointed Extension - 24mm -T40175- and screw it into the Oil Pressure Gauge Kit -VAG1342-.



- Install the Tester in place of the Oil Pressure Switch -F1- into the bracket.
- Connect brown wire -1- of Tester to ground.



- Connect the Voltage Tester -VAS6839- to Battery positive (+) terminal and the Oil Pressure Switch using adapter cables from the Connector Test Set -VAG1594D-.

- Light Emitting Diode (LED) must not light up.

If the LED lights up:

- Replace the 1.4 bar (20.30 psi) Oil Pressure Switch -F1-.

If the LED does not light up:

- Start engine and slowly increase engine speed:
  - The LED must turn on at 1.2 to 1.6 bar (17.4 to 23.2 psi) pressure. If it does not, replace the Oil Pressure Switch -F1-.
- Increase engine speed (RPM) further:
  - At 2000 RPM and an oil temperature of 80 °C (176 °F), the oil pressure should be between 2.7 to 4.5 bar (39.16 to 65.26 psi).

At higher engine speeds oil pressure must not exceed 7 bar (101.52 psi)

If the specification is not obtained:

- Make sure the screen inside the oil intake pipe is not dirty  
-Item 22- ➔ [Item 22 \(page 199\)](#) .



#### Note

*Check also for mechanical damage, for example bearing damage can cause low oil pressure.*

If no error can be found:

- Replace the oil pump. Refer to ➔ [P4.6 ump](#), [page 221](#) .

If the specified value is exceeded:

- Check the oil channels.

## 3.2 Oil Pressure and Reduced Oil Pressure Switch -F378-, Checking

### Special tools and workshop equipment required

- ◆ Oil Pressure Gauge Kit -VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set -VAG1594D-
- ◆ Socket and Jointed Extension - 24mm -T40175-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Vehicle Diagnostic Tester

### Conditions

- Engine oil level OK
- The engine oil temperature is at least 80 °C (176 °F) (the radiator fan must start up once).

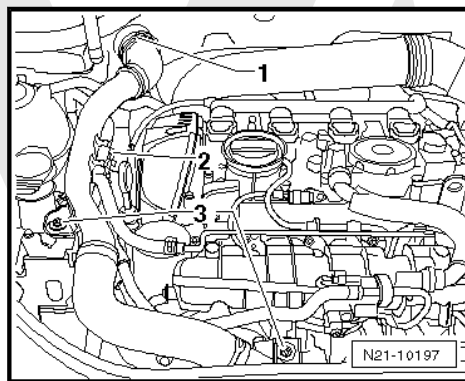


## Note

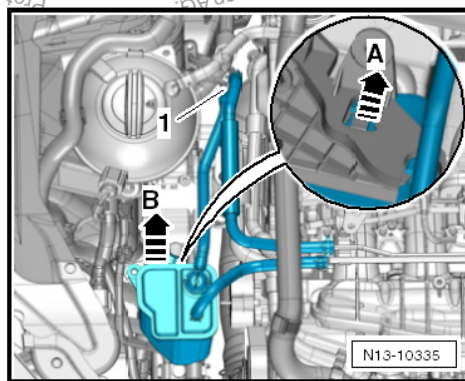
*For the function test and servicing of the optical and acoustic oil pressure warning: Refer to ➤ Wiring diagrams, Troubleshooting & Component locations and the Vehicle Diagnostic Tester "Function and Component Selection".*

### Oil Pressure, Checking

- Vehicles with sound generator: open the locking mechanism -1-, unclip the fuel line -2- and loosen the bolt -3- on the Evaporative Emission (EVAP) canister. Move the charge air pipe aside.



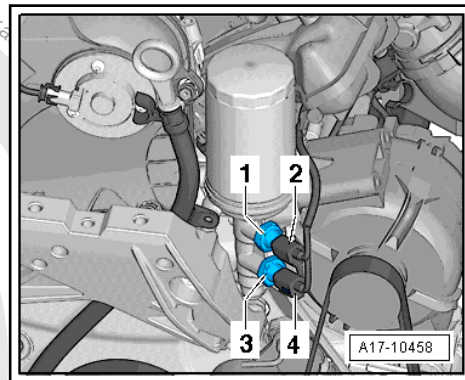
- Disconnect the vent line -1-, unlock the EVAP canister in direction of -arrow A- and remove it upward in direction of -arrow B-. Move the EVAP canister to the side.



## Note

*Place a cloth under the sub-assembly bracket to collect leaking engine oil.*

- Disconnect the connector -2- from the Reduced Oil Pressure Switch -F378- (brown).



- Remove the Reduced Oil Pressure Switch -F378- -1-.
- Install the Oil Pressure Gauge Kit -VAG1342- into the oil filter bracket in place of the oil pressure switch.
- Install the Reduced Oil Pressure Switch -F378- in the Oil Pressure Gauge Kit -VAG1342-.
- Connect the charge air pipe and EVAP canister vent line.
- Start the engine.
- Oil pressure when the vehicle is idling: 1.2 to 2.0 bar (17.4 to 29 psi)
- Oil pressure at 2000 RPM: 1.6 to 2.1 bar (23.2 to 30.5 psi)
- Oil pressure at 3700 RPM: 3 to 4.3 bar (43 to 62.3 psi)



#### Note

*The oil pressure may be 3 to 4 bar (43 to 58 psi) at 2,000 RPM during the first 1,000 km (621 miles).*

If the specification is not obtained:

- Make sure the screen inside the oil intake pipe is not dirty -Item 22- ➔ [Item 22 \(page 199\)](#) .
- Check the Oil Pressure Regulation Valve -N428-. Refer to Vehicle Diagnostic Tester.



#### Note

*Also, mechanical damage, for example, bearing damage can also be the cause of too low oil pressure.*

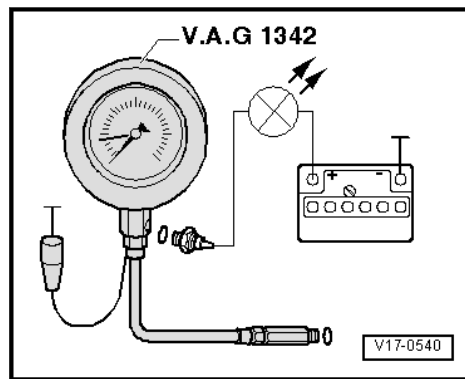
If no error can be found:

- Replace the oil pump. Refer to ➔ [P4.6 ump", page 221](#) .

#### Checking the Reduced Oil Pressure Switch -F378- (Brown):

- Turn off the engine.
- Connect brown wire on the tester to the ground (-).





- Connect the Voltage Tester -VAS6839- with adapter cables from the Connector Test Set -VAG1594D- to the battery positive (+) and the Reduced Oil Pressure Switch -F378- (brown).

- Light Emitting Diode (LED) must not light up.
- If the LED illuminates, replace the Reduced Oil Pressure Switch -F378-.

If the LED does not light up:

- Start the engine: the LED must come on at 0.55 to 0.85 bar (7.97 to 12.32 psi). If it does not, replace the oil pressure switch.

#### Checking the Oil Pressure Switch -F22- (Blue):

- Turn off the engine.
- Connect the Voltage Tester -VAS6839- to battery positive (+) and the Oil Pressure Switch - F22- (blue) using adapter cables from the Connector Test Set - VAG1594D-.
- LED must not light up.
- If the LED illuminates, replace the Oil Pressure Switch -F22-.

If the LED does not light up:

- Start the engine and increase the RPM: the LED must come on at 2.15 to 2.95 bar (31.18 to 42.78 psi) (pressure; if not, then replace the oil pressure switch.



## 4 Removal and Installation

⇒ [O4.1 il Cooler", page 211](#)

⇒ [P4.2 an Lower Section", page 212](#)

⇒ [P4.3 an Upper Section", page 215](#)

⇒ [O4.4 il Pressure Regulation Valve N428 ", page 219](#)

⇒ [O4.5 il Pressure Switch F22 ", page 220](#)

⇒ [P4.6 ump", page 221](#)

⇒ [S4.7 eparator", page 223](#)

⇒ [R4.8 educed Oil Pressure Switch F378 ", page 224](#)

### 4.1 Engine Oil Cooler

#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-

#### Removing

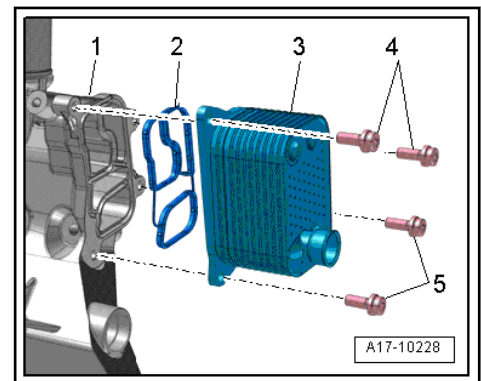


#### WARNING

*Risk of scalding due to hot steam and hot coolant:*

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Wear protective eyewear and protective clothing to prevent eye injury and scalding.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

- Drain the coolant. Refer to [⇒ D1.1 raining and Filling", page 229](#) .
- Remove the sub-assembly bracket. Refer to [⇒ B5.8 racket", page 76](#) .
- Remove the bolts -4 and 5- and remove the engine oil cooler -3- with the seal -2-.



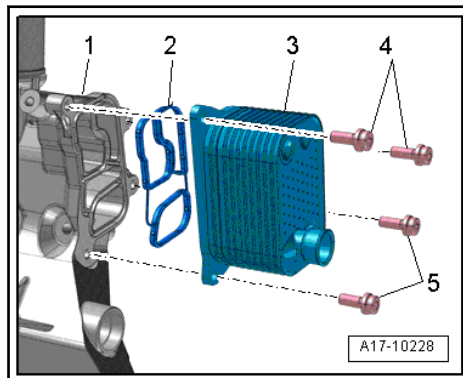
#### Installing

- ◆ Tightening specifications. Refer to [⇒ -2.2 Oil Filter Housing/Oil Pressure SwitchF1 ", page 201](#) .



Install in reverse order of removal. Note the following:

- ◆ Replace the gaskets and seals.
- ◆ Install only approved clamps for securing hose connections.  
Refer to the Parts Catalog.
- Install the engine oil cooler -3- with a new seal -2-.



## 4.2 Oil Pan Lower Section

### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Silicone Sealant -D 174 003 A2-
- ◆ Flat scraper
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear

### Removing

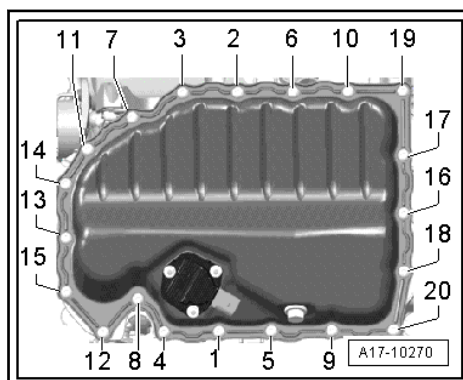
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66; Noise Insulation; Noise Insulation Removing and Installing.
- Drain the engine oil. Refer to ⇒ Maintenance; Booklet 20.1.



### Note

Observe the disposal regulations!

- Remove the bolts in sequence -20 through 1-



- Remove the lower oil pan section, and if necessary loosen by applying light strikes with a rubber hammer.



## Installing

Tightening specifications. Refer to ➔ [-2.1 Oil Pan/Oil Pump-](#),  
[page 197](#).



### Note

- ◆ *Sealing surfaces must be completely free of oil and grease.*
- ◆ *Note the expiration date of the Silicone Sealant.*
- ◆ *The lower oil pan section must be installed within 5 minutes after applying the silicone sealant.*
- ◆ *Replace the bolts which are being tightened with an additional turn.*
- ◆ *Replace sealing rings, seals and self-locking nuts.*
- Remove sealant residue from upper section of the oil pan with a flat-blade scraper.

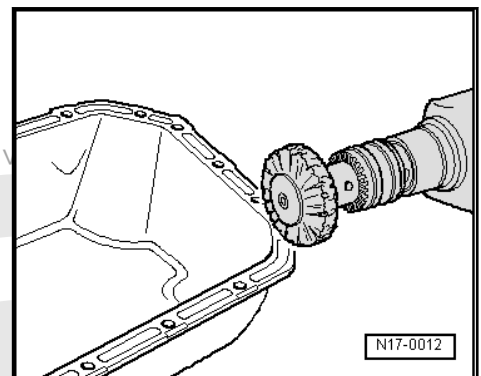


### WARNING

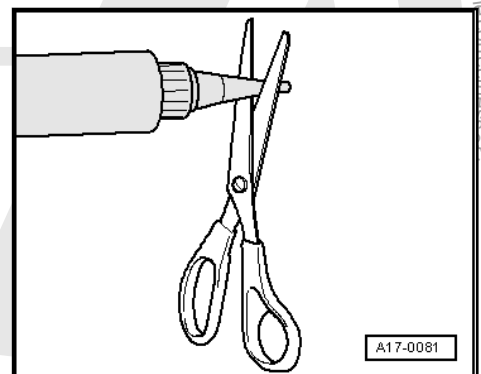
*Danger of eye injury.*

- ◆ *Wear protective eyewear.*

- Remove sealant residue on the lower section of the oil pan, for example with a rotating plastic brush.

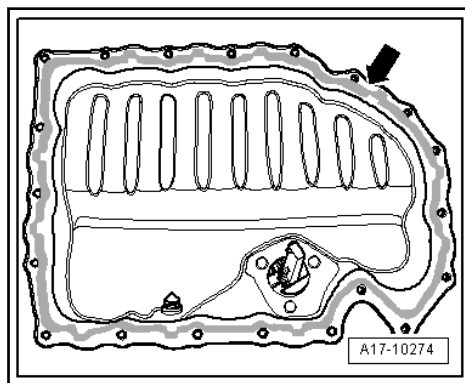


- Clean the sealing surfaces. They must be free of oil and grease.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 3 mm).





- Apply the Silicone Sealant on the clean sealing surface of the cylinder head cover as shown -arrow-.

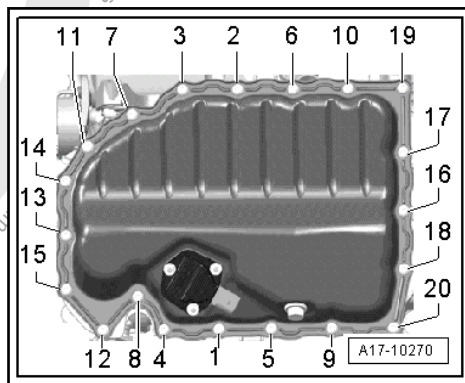


- Sealant bead thickness: 2 to 3 mm.



#### Note

- ♦ The lower oil pan section must be installed within 5 minutes after application of Silicone Sealant.
  - ♦ The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.
  - ♦ Pay attention to the expiration date of the sealant.
- Immediately mount the oil pan lower section and tighten the new bolts -1 through 20- in three stages as follows:



- 1 - Tighten Bolts Hand-Tight.
- 2 - Tighten the Bolts to 8 Nm.
- 3 - Turn the Bolts an Additional 45°.



#### Note

*After installing the oil pan lower section, the sealant must dry for approximately 30 minutes. Only after then may the engine oil be replenished.*

Install in reverse order of removal. Note the following:

- Fill with engine oil. Refer to ➤ Maintenance; Booklet 20.1.
- Check oil level. Refer to ➤ [page 195](#) .



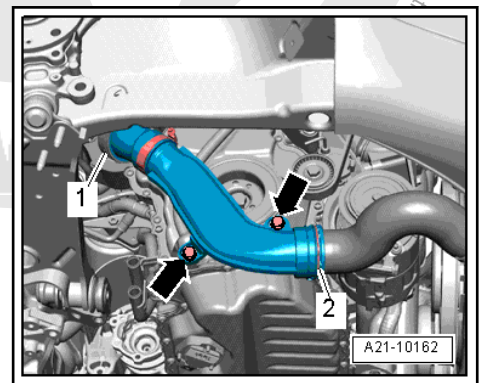
## 4.3 Oil Pan Upper Section

### Special tools and workshop equipment required

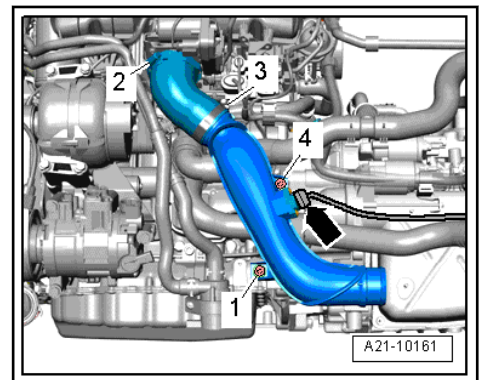
- ◆ Gauge - Brake Pad -VW136-
- ◆ Elbow Assembly Tool -T10118-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Silicone Sealant -D 174 003 A2-
- ◆ Flat scraper
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear

### Removing

- Remove the transmission. Refer to one of the following:
  - ◆ ⇒ Manual Transmission; Rep. Gr. 34; Removal and Installation.
  - ◆ ⇒ Direct Shift Gearbox; Rep. Gr. 34; Removal and Installation.
- Remove the oil pump. Refer to ⇒ [P4.6 ump", page 221](#) .
- Remove the transmission side sealing flange. Refer to ⇒ [F5.6 lange, Removing and Installing, Transmission Side", page 67](#) .
- Remove the right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Remove the bolts -arrows-.



- Open the clamps -1 and 2- and remove the charge air pipe.
- Remove the bolt -1-.





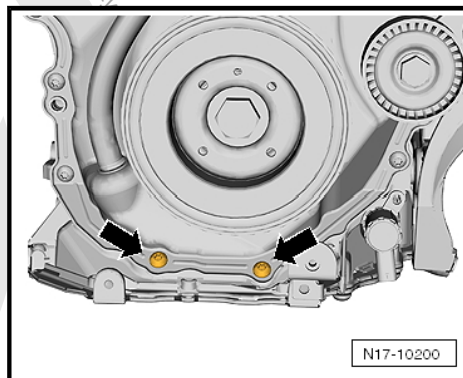
- Remove the wiring harness bracket next to the After-Run Coolant Pump - V51- from the oil pan upper section.



#### Caution

*To prevent leaks in the future, do not bend the lower timing chain cover and do not reach between the mounting points.*

- Remove the bolts -arrows-.



#### WARNING

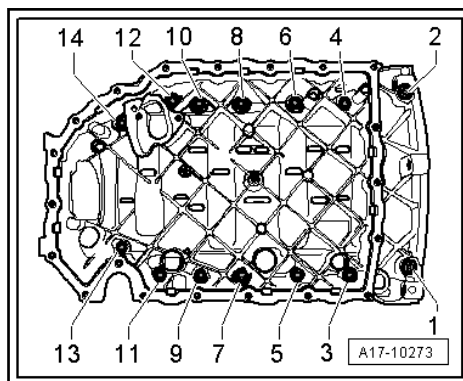
*Risk of injury! When removing the oil pan upper section, the chain tensioner spring for the oil pump motor will jump from the oil pan upper section to the lower timing chain cover. When removing the oil pan upper section, do not reach between the section and the lower timing chain cover.*



#### Caution

*First pry the oil pan upper section out on the transmission side. When prying out, be careful not to bend the timing chain cover.*

- Remove the bolts in sequence -14 through 1- and pry off the oil pan upper section.



#### Installing

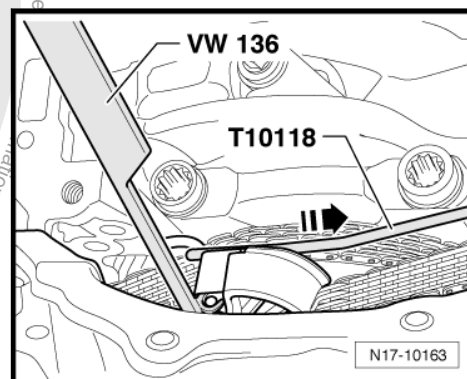
Tightening specification. Refer to ➤ [-2.1 Oil Pan/Oil Pump-](#), [page 197](#).





# **Note**

- ◆ *Sealing surfaces must be completely free of oil and grease.*
- ◆ *Note the expiration date of the Silicone Sealant.*
- ◆ *The oil pan upper section must be installed within five minutes after applying the Silicone Sealant.*
- Use the Elbow Assembly Tool -T10118- and pull the chain tensioner spring for the oil pump drive in direction of -arrow-.



- Secure the spring by inserting the Gauge - Brake Pad -VW136- into the hole in the glide rail as shown.
- Remove the sealant residue from cylinder block with a flat-blade scraper.

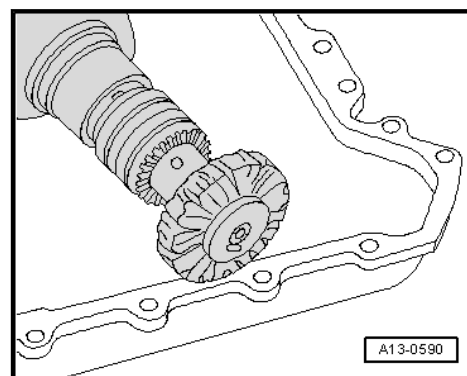


## **WARNING**

***Danger of eye injury.***

- ◆ ***Wear protective eyewear.***

- Remove the remaining sealant on the upper section of the oil an on the lower timing chain cover, for example with a rotating plastic brush.

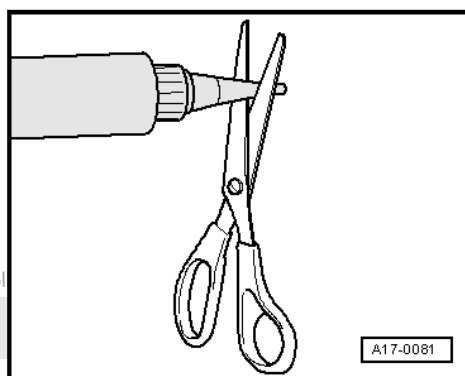




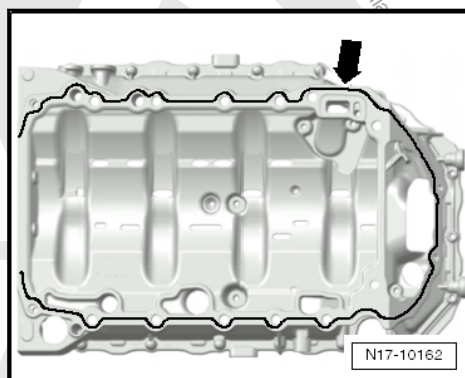
#### Note

*See if the timing chain cover is deformed. Then mount the oil pan upper section without any sealant and check the gap between the cover and the oil pan upper section. If a deformation is found and the cover cannot be aligned, replace the cover after installing the oil pan upper section.*

- Clean the sealing surfaces. They must be free of oil and grease.
- Make sure the oil channels in the oil pan upper section and in the cylinder crankcase are clean.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 3 mm).



- Apply the Silicone Sealant on the clean sealing surface of the upper oil pan section as shown -arrows-.



- Sealant bead thickness: 2 to 3 mm.

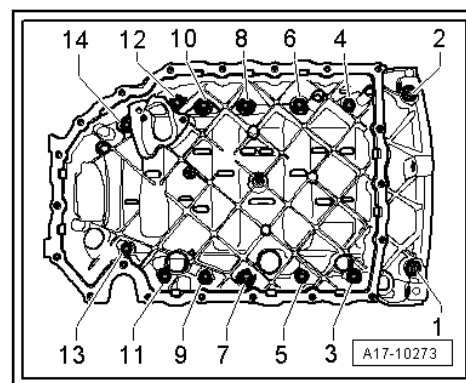


#### Note

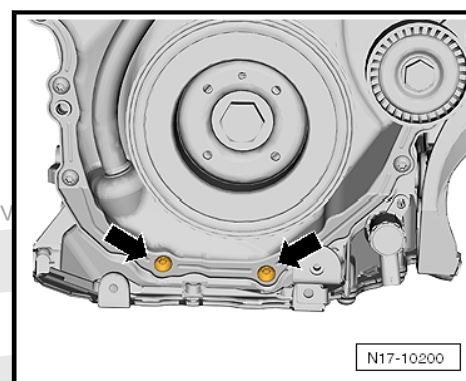
- ◆ *The oil pan upper section must be installed within five minutes after applying the Silicone Sealant.*
- ◆ *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*
- On the transmission side, the oil pan upper section and the crankcase must align.
- Immediately mount the upper section of the oil pan and tighten the bolts in three steps as follows:



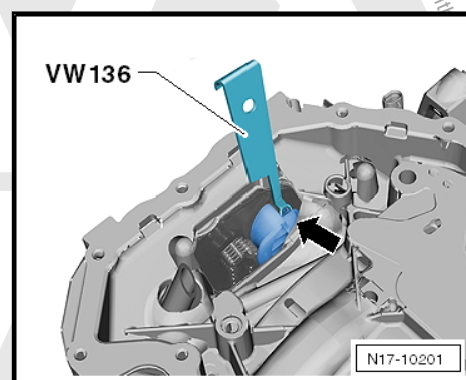
Bolts -1 through 14-.



- 1 - Tighten Bolts Hand-Tight.
  - 2 - Tighten the Bolts to 15 Nm.
  - 3 - Tighten the Bolts an Additional 90°.
- Install the bolts -arrows-. Tightening specification. Refer to ➔ [Fig. "Lower Timing Chain Cover - Tightening Specifications and Tightening Sequence", page 105](#).



- Remove the Gauge - Brake Pad -VW136- from the glide rail -arrow-. The spring now returns to the installation position.



Further assembly is performed the reverse order of the removal.

#### 4.4 Oil Pressure Regulation Valve -N428-

Special tools and workshop equipment required

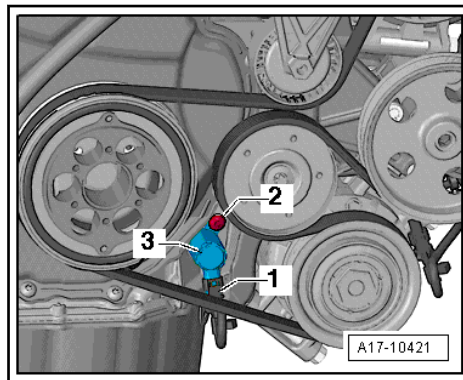
- ◆ Used Oil Collection and Extraction Unit -SMN372500-

##### Removing

- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.



- Place the Used Oil Collection and Extraction Unit - SMN372500- under the engine.
- Disconnect the connector -1-.
- Remove the bolt -2- and the Oil Pressure Regulation Valve -N428- -3-.



### Installing

Install in reverse order of removal while noting the following:

- ♦ Replace the O-ring.
- ♦ Tightening specification -Item 12- ➔ [Item 12 \(page 198\)](#) .

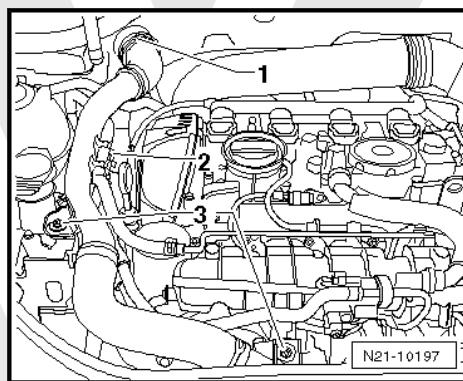
## 4.5 Oil Pressure Switch -F22-

### Special tools and workshop equipment required

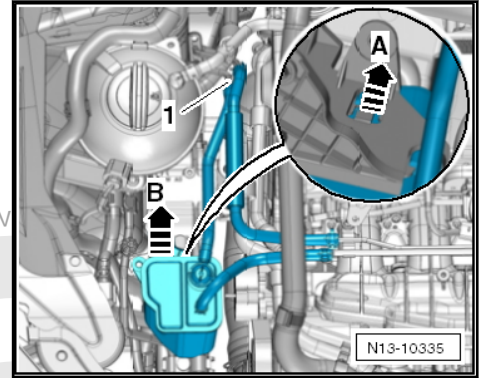
- ♦ Socket and Jointed Extension - 24mm -T40175-

### Removing

- Vehicles with sound generator: open the locking mechanism -1-, unclip the fuel lines -2- and loosen the bolt -3- on the Evaporative Emission (EVAP) canister. Move the charge air pipe aside.



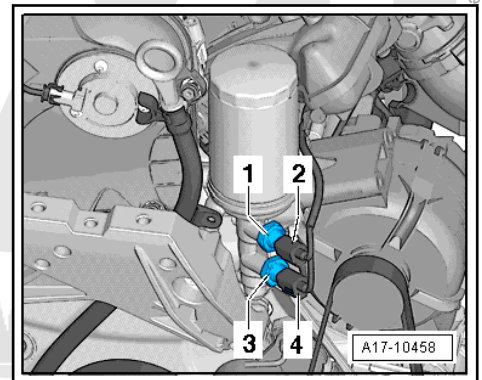
- Disconnect the vent line -1-, unlock the EVAP canister -A- and remove it upward -B-. Move the EVAP canister to the side.



#### Note

Place a cloth under the sub-assembly bracket to collect leaking engine oil.

- Disconnect the connector -4- from the Oil Pressure Switch -F22-.
- Remove the Oil Pressure Switch -F22- -3-.



#### Installing

- ◆ Tightening specification. Refer to ➤ [-2.3 Oil Filter Housing/Oil Pressure Switch F22 and Reduced Oil Pressure Switch F378](#) , page 203 .

Install in reverse order of removal. Note the following:

- ◆ Replace the seal.
- ◆ To prevent coolant loss, insert the new Oil Pressure Switch -F22- in the hole immediately.
- ◆ Check the oil level.

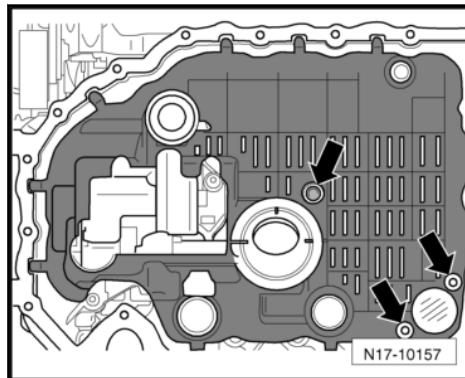
### 4.6 Oil Pump

#### Special tools and workshop equipment required

- ◆ Elbow Assembly Tool -T10118-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

#### Removing

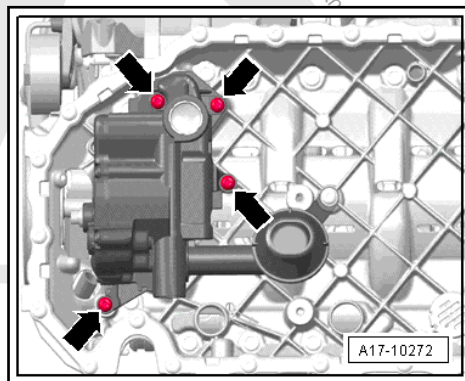
- Remove the oil pan lower section. Refer to ➤ [P4.2 an Lower Section](#) , page 212 .
- Remove the oil baffle -arrows-.



#### Note

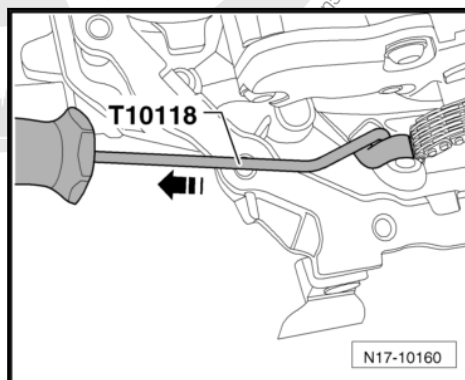
*The following procedure must be performed in one step. A second technician is needed.*

- Remove the bolts -arrows-.



#### Installing

- Pull the chain tensioner back using the Elbow Assembly Tool -T10118- and mount the drive chain on the oil pump and oil intake pipe.



Installation is performed in reverse order of the removal. Note the following:

- ♦ Tightening specification. Refer to ➤ [-2.1 Oil Pan/Oil Pump-](#), [page 197](#).
- Check the strainer in the oil intake pipe and the oil channels in the oil pan upper section for contamination before installing the oil pump.





- Make sure there are both alignment bushings for centering the oil pump.
- Replace the baffle plate.

The oil baffle gets a new check valve (-Item 26- ➔ [Item 26 \(page 199\)](#) ), and a new seal -Item 23- ➔ [Item 23 \(page 199\)](#) .

### Note

*There are plastic ribs on the oil baffle that deform permanently when tightening. The plastic ribs ensure the oil baffle has no play and does not rattle. Because of this, always replace the oil baffle.*

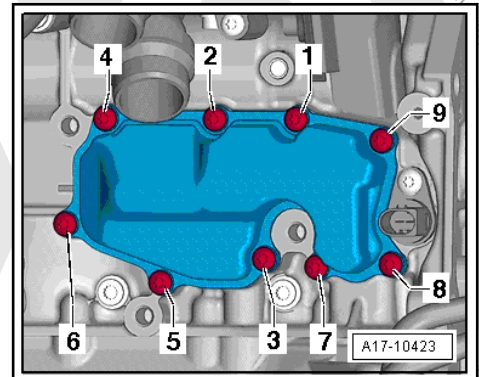
## 4.7 Oil Separator

### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

### Removing

- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the bolts -9 through 1- and remove the oil separator.



### Caution

***Risk of contaminating the lubricating system.***

- ◆ ***Seal the opening with a clean cloth.***

### Installing

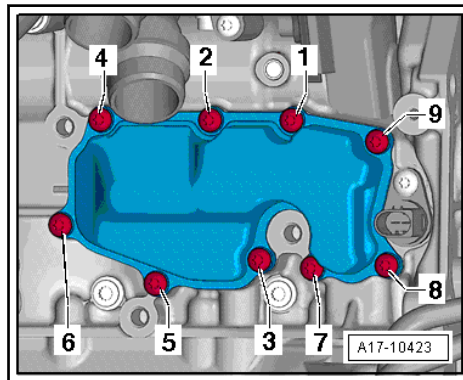
### Note

- ◆ *Replace the gaskets and seals.*
- ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*

Install in reverse order of removal. Note the following:

- Tighten the bolts in the sequence -1 to 9-.





Tightening specification: 9 Nm.

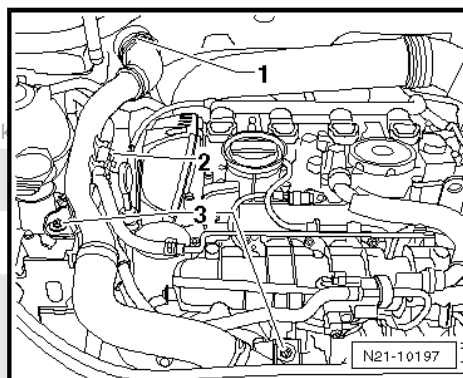
## 4.8 Reduced Oil Pressure Switch -F378-

### Special tools and workshop equipment required

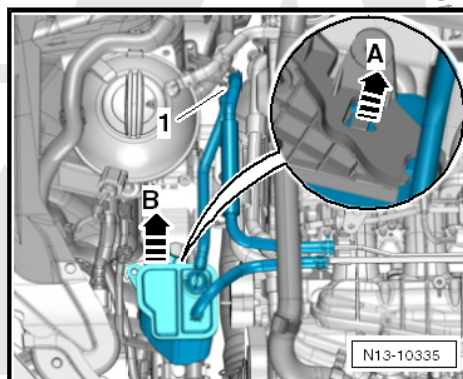
- ◆ Socket and Jointed Extension - 24mm -T40175-

### Removing

- Vehicles with sound generator: open the locking mechanism -1-, unclip the fuel lines -2- and loosen the bolt -3- on the Evaporative Emission (EVAP) canister. Move the charge air pipe aside.



- Disconnect the vent line -1-, unlock the EVAP canister in direction of -arrow A- and remove it upward in direction of -arrow B-. Move the EVAP canister to the side.

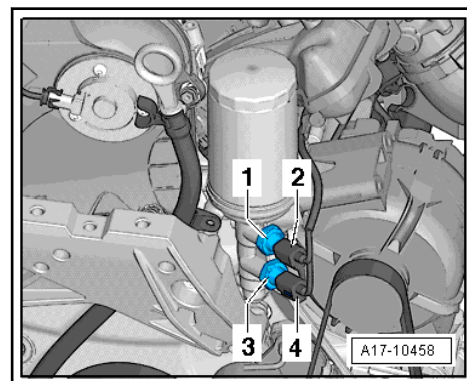


### Note

Place a cloth under the sub-assembly bracket to collect leaking engine oil.



- Disconnect the connector -2- from the Reduced Oil Pressure Switch -F378-.



- Remove the Reduced Oil Pressure Switch -F378- -1-.

#### Installing

- ◆ Tightening specification. Refer to ➤ [-2.3 Oil Filter Housing/Oil Pressure Switch F22 and Reduced Oil Pressure Switch F378-](#), page 203 .

Install in reverse order of removal. Note the following:

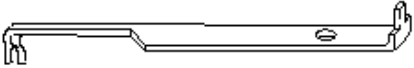
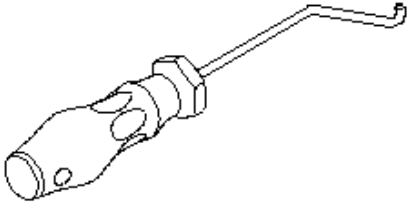

- ◆ Replace the seal.
- ◆ To prevent coolant loss, insert the new Oil Pressure Switch in the hole immediately.
- ◆ Check the oil level.



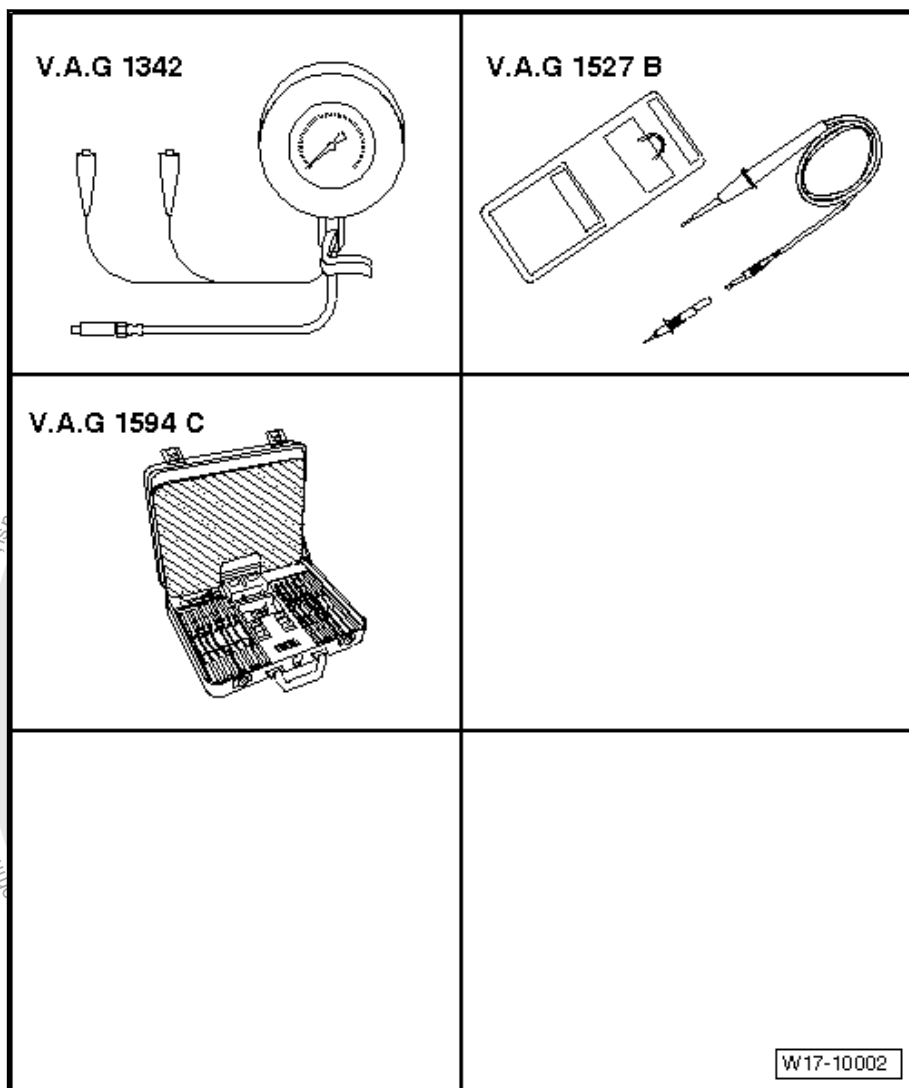


## 5 Special Tools

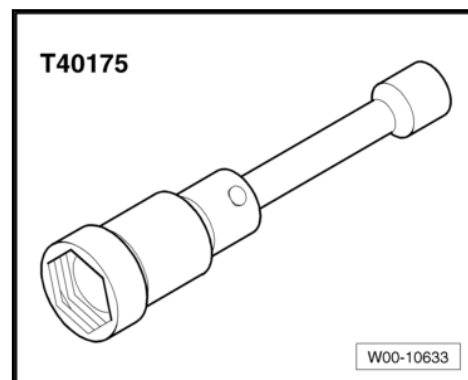
Special tools and workshop  
equipment required

<b>VW 136</b> 	<b>T10118</b> 
<b>V.A.G 1331</b> 	
	<b>W17-10010</b>

- ◆ Gauge - Brake Pad -VW136-
- ◆ Elbow Assembly Tool -T10118-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Silicone Sealant -D 174 003 A2-

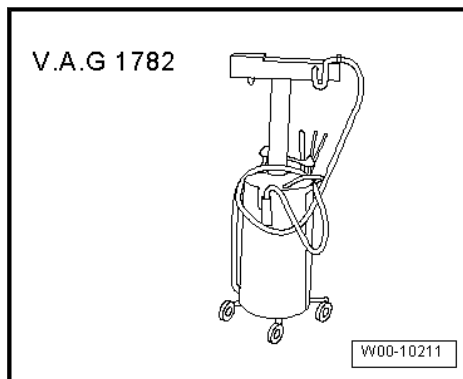


- ◆ Oil Pressure Gauge Kit -VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set -VAG1594D-
- ◆ Socket and Jointed Extension - 24mm -T40175-

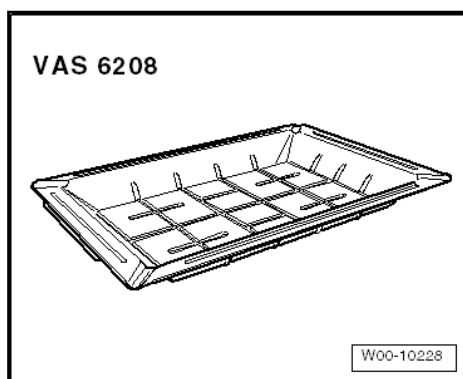




◆ Used Oil Collection and Extraction Unit -SMN372500-



◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-



◆ Vehicle Diagnostic Tester





## 19 – Cooling System

### 1 General Information

⇒ **D1.1 raining and Filling”, page 229**

#### 1.1 Coolant, Draining and Filling

Special tools and workshop equipment required

- ◆ Refractometer -T10007A-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Spring Clip Pliers
- ◆ Cooling System Charge Kit -VAS6096-
- ◆ Cooling System Tester - Adapter -VAG1274/8-
- ◆ Coolant Additive -G 12 plus-plus-



#### WARNING

*Risk of scalding due to hot steam and hot coolant:*

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Wear protective eyewear and protective clothing to prevent eye injury and scalding.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*



#### Caution

- ◆ *When doing any assembly work, especially in the engine compartment, pay attention to the following due to the limited space.*
- ◆ *Route lines of all types (for example, for fuel, hydraulic, Evaporative Emission (EVAP) system, coolant, refrigerant, brake fluid, vacuum) and wires so that the original routing is restored.*
- ◆ *To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.*



#### Note

- ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*
- ◆ *The arrows on coolant pipes and ends of coolant hoses must align when installing.*





## Draining

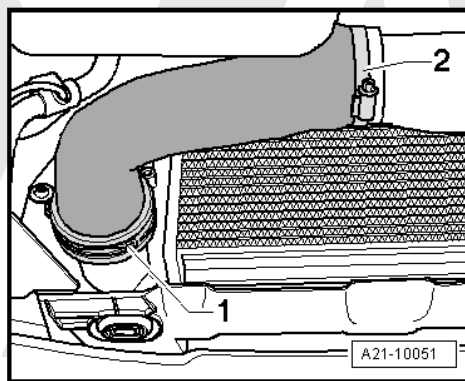


### WARNING

**Risk of scalding due to hot steam and hot coolant:**

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Wear protective eyewear and protective clothing to prevent eye injury and scalding.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

- Open cap on coolant expansion tank.
- Remove the noise insulation. Refer to Rep. Gr. 50; Description and Operation.
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



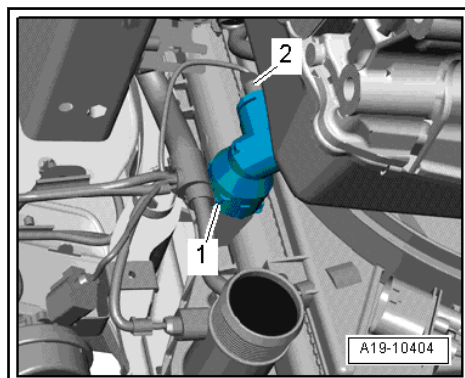
- Seal off the connections on the charge air cooler with a clean cloth.



### Note

*Collect escaping coolant in a clean container for disposal or reuse.*

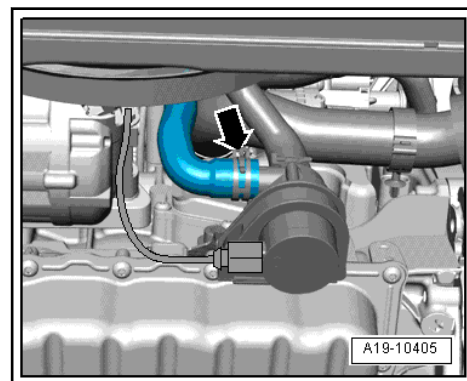
- Place a Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208- under the engine.
- Remove the lower coolant hose -1- from the radiator and let the coolant drain.







- Remove the lower coolant hose to the After-Run Coolant Pump -V51- -arrow- and allow the coolant to drain.



## Filling



### Note

- ◆ *The water portion of the coolant greatly influences the effectiveness of the coolant.*
- ◆ *Volkswagen has decided to define the water quality used in the cooling system based on the different mixtures and country and regional requirements.*
- ◆ *Distilled water fulfills all requirements.*
- ◆ *For this reason, we recommend using distilled water for older models when adding coolant or filling coolant for the first time.*



### Caution

**Only use distilled water for mixing with G12 plus-plus. Using distilled water provides optimum corrosion protection.**



## Note

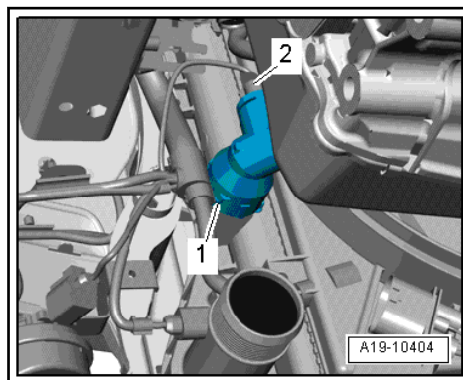
- ◆ Only use Coolant Additive -G12 plus-plus- that conforms to TL VW774 G.
- ◆ Coolant Additives with the note "conforming to TL VW774 G" prevent frost and corrosion damage, scaling and also raise the boiling temperature. The cooling system must be filled with coolant additive year-round.
- ◆ Because of its high boiling point, the coolant contributes to engine reliability under heavy engine loads, particularly in countries with tropical climates.
- ◆ Freeze protection must be assured to about -25 °C (-13 °F) (in arctic climatic countries to about -35 °C (-31 °F)).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive portion must be at least 40%.
- ◆ If greater frost protection is required for climatic reasons, the amount of Coolant Additive can be increased, but only up to 60% (frost protection down to approximately -40 °C (-40 °F)), otherwise the freeze protection and cooling effect will be reduced.
- ◆ The Refractometer -T10007- is recommended for determining the current anti-freeze density.
- ◆ Do not use the old coolant again if replacing the radiator, heater core, cylinder head or cylinder head gasket.

## Recommended Mixture Ratios

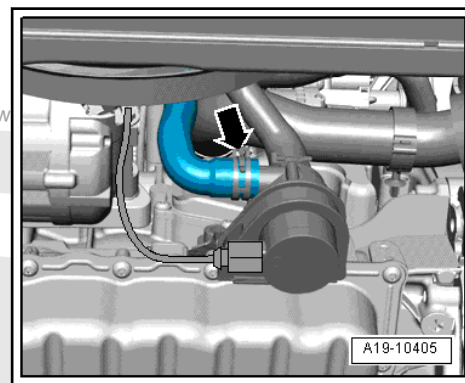
Frost Protection to	Anti-Freeze	- G 12 plus-plus- 1)	Distilled Water <sup>1)</sup>
-25 °C (-13 °F)	40%	3.2 liters (3.3 quarts)	4.8 liters (5 qts)
-35 °C (-31 °F)	50%	4.0 liters (4.2 quarts)	4.0 liters (4.2 quarts)

<sup>1)</sup> The amount of coolant may vary depending on vehicle equipment.

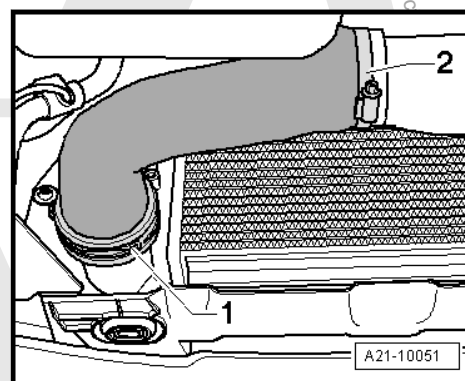
- Connect the lower coolant hose -1- to the radiator.



- Connect the coolant hose to the After-Run Coolant Pump -V51- -arrow-.



- Install the charge air hose -1 and 2-.



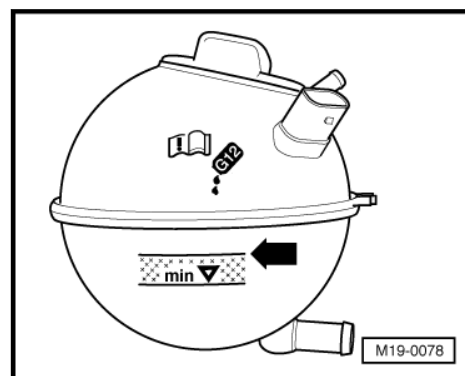
- Install the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.

#### With Cooling System Charge Kit -VAS6096-:

- Install the Cooling System Tester - Adapter -VAG1274/8- on the expansion tank.
- Fill the coolant circuit using Cooling System Charge Kit -VAS6096-. Refer to Operating Instructions for Cooling System Charge Kit -VAS6096-.

#### Without Cooling System Charge Kit -VAS6096-

- Slowly fill coolant up to top marking of hatched area -arrow- on expansion tank.



- Close the reservoir.
- Turn off the Air Conditioning (A/C) and the heater.
- Start the engine and maintain an engine speed of about 2000 RPM for approximately 3 minutes.



- Allow the engine to run until the Coolant Fan -V7- starts running.



#### WARNING

***Risk of scalding due to hot steam and hot coolant:***

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective eyewear and protective clothing to prevent eye injury and scalding.***
- ◆ ***Reduce pressure by covering coolant reservoir cap with a cloth and carefully open.***

- Close the reservoir and check the coolant level. Fill the coolant when the engine is cold, if necessary.
- With engine at operating temperature, coolant level must lie at top marking of hatched area -arrow-.
- With engine cold, coolant level should be located approximately in the center of hatched area.





## 2 Description and Operation

⇒ [D2.1 Diagram - Coolant Hoses](#), page 235

⇒ [-2.2 Coolant Pipes](#), page 236

⇒ [-2.3 Coolant Pump/Thermostat](#), page 237

⇒ [-2.4 Electric Coolant Pump](#), page 239

⇒ [-2.5 Radiator/Coolant Fan](#), page 240

### 2.1 Connection Diagram - Coolant Hoses

⇒ [D2.1.1 Diagram - Coolant Hoses, Vehicles with Manual Transmission](#), page 235

⇒ [D2.1.2 Diagram - Coolant Hoses, Vehicles with DSG® Transmission](#), page 235

#### 2.1.1 Connection Diagram - Coolant Hoses, Vehicles with Manual Transmission

1 - Radiator

2 - After-Run Coolant Pump  
-V51-

3 - Coolant Pump

4 - Coolant Thermostat

5 - Engine Oil Cooler

6 - Cylinder Head and Cylinder Block

7 - Turbocharger

8 - Coolant Reservoir

☐ With cap

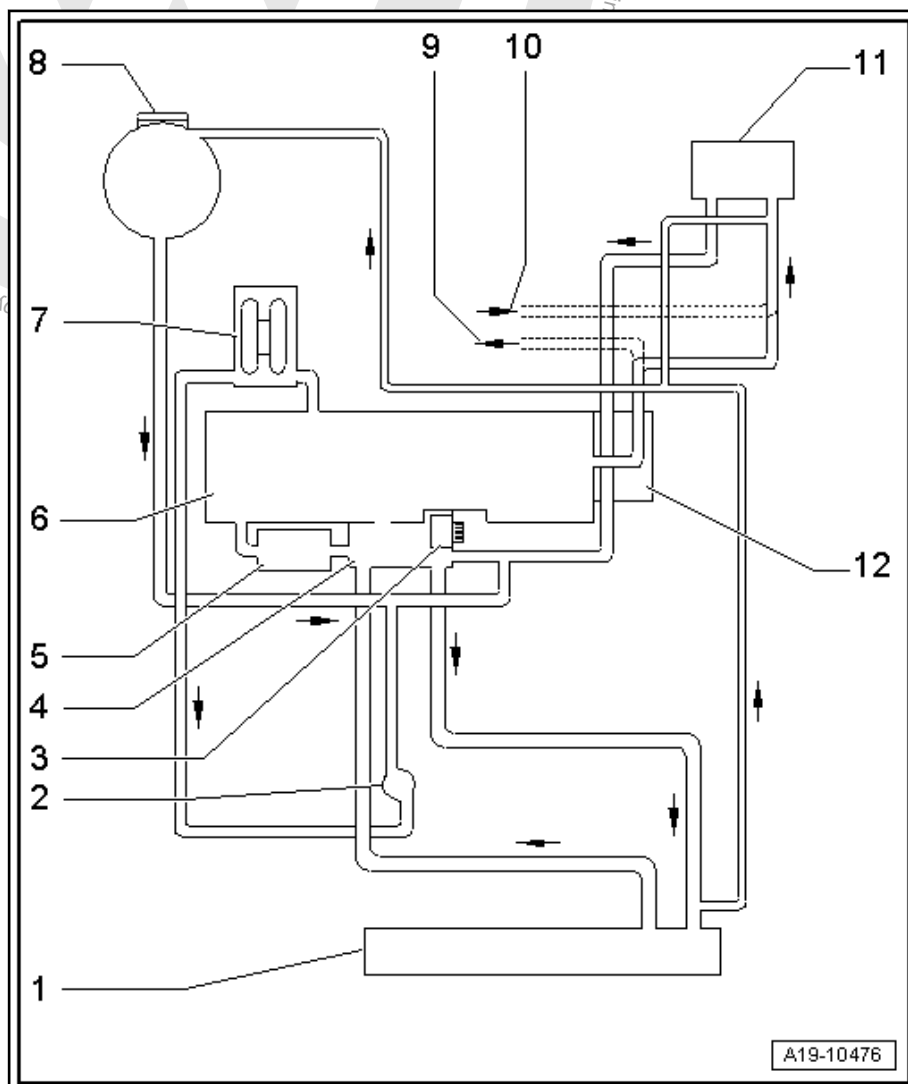
☐ Check the pressure  
valve in the cap. Refer to [⇒ S3.1 System,  
Checking for Leaks](#),  
page 243

9 - To Auxiliary Heater

10 - From Auxiliary Heater

11 - Heater Core

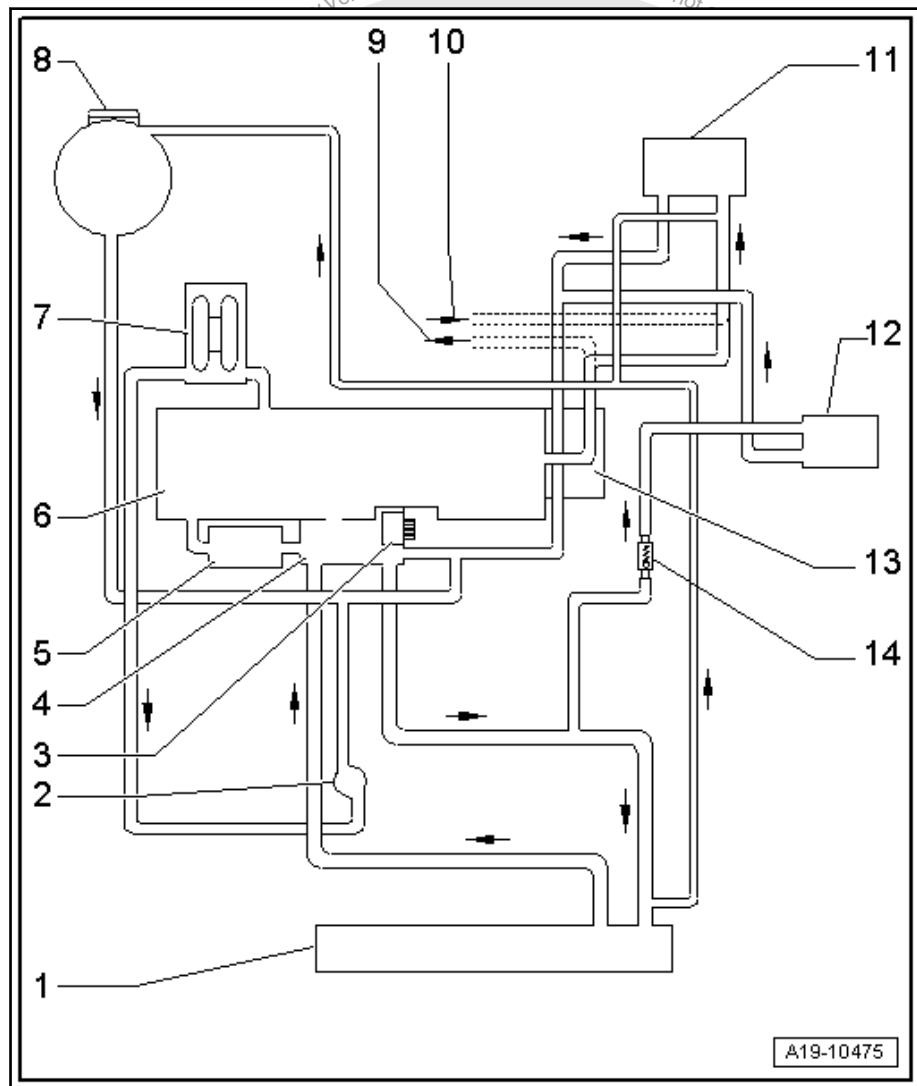
12 - Coolant Connection



#### 2.1.2 Connection Diagram - Coolant Hoses, Vehicles with DSG® Transmission



- 1 - Radiator
- 2 - After-Run Coolant Pump -V51-
- 3 - Coolant Thermostat
- 4 - Coolant Pump
- 5 - Engine Oil Cooler
- 6 - Cylinder Head and Cylinder Block
- 7 - Turbocharger
- 8 - Coolant Reservoir
  - ☐ With cap
  - ☐ Check the pressure valve in the cap. Refer to ➤ [S3.1 ystem, Checking for Leaks](#), page 243
- 9 - To the Auxiliary Heater
- 10 - From the Auxiliary Heater
- 11 - Heater Core
- 12 - Transmission Fluid Cooler
- 13 - Coolant Connection
- 14 - Coolant Thermostat for the Transmission Fluid Cooler
  - ☐ On some vehicles, the thermostat is located on the outflow side of the transmission oil cooler -Item 12- ➤ [Item 12 \(page 236\)](#) .



## 2.2 Overview - Coolant Pipes



### Note

- ◆ Install only approved clamps for securing hose connections. Refer to the Parts Catalog.
- ◆ The arrows on coolant pipes and ends of coolant hoses must align when installing.

Coolant hose connection diagram. Refer to ➤ [D2.1 iagram - Coolant Hoses](#), page 235 .



### 1 - Front Coolant Pipes

- ☐ Removing and installing. Refer to ➤ [C4.9 Coolant Pipes](#), page 261.

### 2 - Coolant Hose

- ☐ From the turbocharger

### 3 - Coolant Hose

- ☐ To coolant expansion tank

### 4 - Bolt

- ☐ 5 Nm

### 5 - O-Ring

- ☐ Always replace

### 6 - Coolant Hose

- ☐ To heater core

### 7 - Small Coolant Pipe

- ☐ Removing and installing. Refer to ➤ [C4.11 Coolant Pipe](#), page 266.

### 8 - Bolts

- ☐ 9 Nm

### 9 - Coolant Hose

### 10 - Bolt

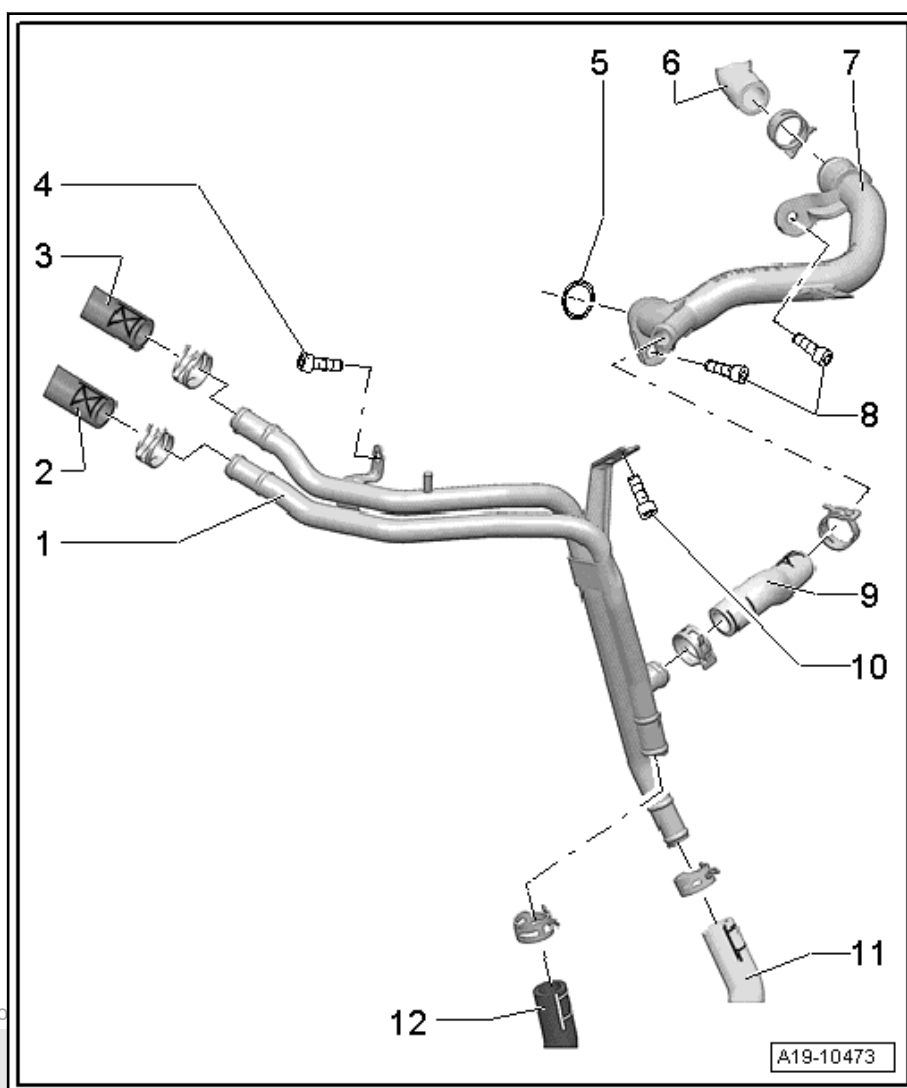
- ☐ 5 Nm

### 11 - Coolant Hose

- ☐ From the After-Run Coolant Pump -V51-

### 12 - Coolant Hose

- ☐ To the After-Run Coolant Pump -V51-



## 2.3

## Overview - Coolant Pump/Thermostat





#### 1 - Bolt

- ☐ Tightening sequence and specification. Refer to [⇒ Fig. "Coolant Pump Tightening Sequence and Tightening Specification", page 239](#).

- ☐ 9 Nm

#### 2 - O-Ring

- ☐ Always replace
- ☐ Coat with coolant

#### 3 - Connection

#### 4 - Clip

- ☐ Only with the attached version
- ☐ Make sure it is secure

#### 5 - Bolt

- ☐ 4 Nm
- ☐ Only with the bolted version

#### 6 - Retaining Plate

- ☐ Only with the bolted version

#### 7 - Engine Coolant Temperature Sensor -G62-

- ☐ Removing and installing. Refer to [⇒ E4.7 Engine Coolant Temperature Sensor G62", page 255](#).

#### 8 - O-Ring

- ☐ Always replace

#### 9 - Coolant Pump

- ☐ Removing and installing. Refer to [⇒ P4.2 ump", page 245](#).
- ☐ For a new coolant pump, remove the protective cap

#### 10 - Seal

- ☐ Always replace

#### 11 - Centering Pin

- ☐ Quantity: 2

#### 12 - Toothed Belt

- ☐ For the coolant pump
- ☐ Removing and installing. Refer to [⇒ P4.3 ump Toothed Belt", page 247](#).

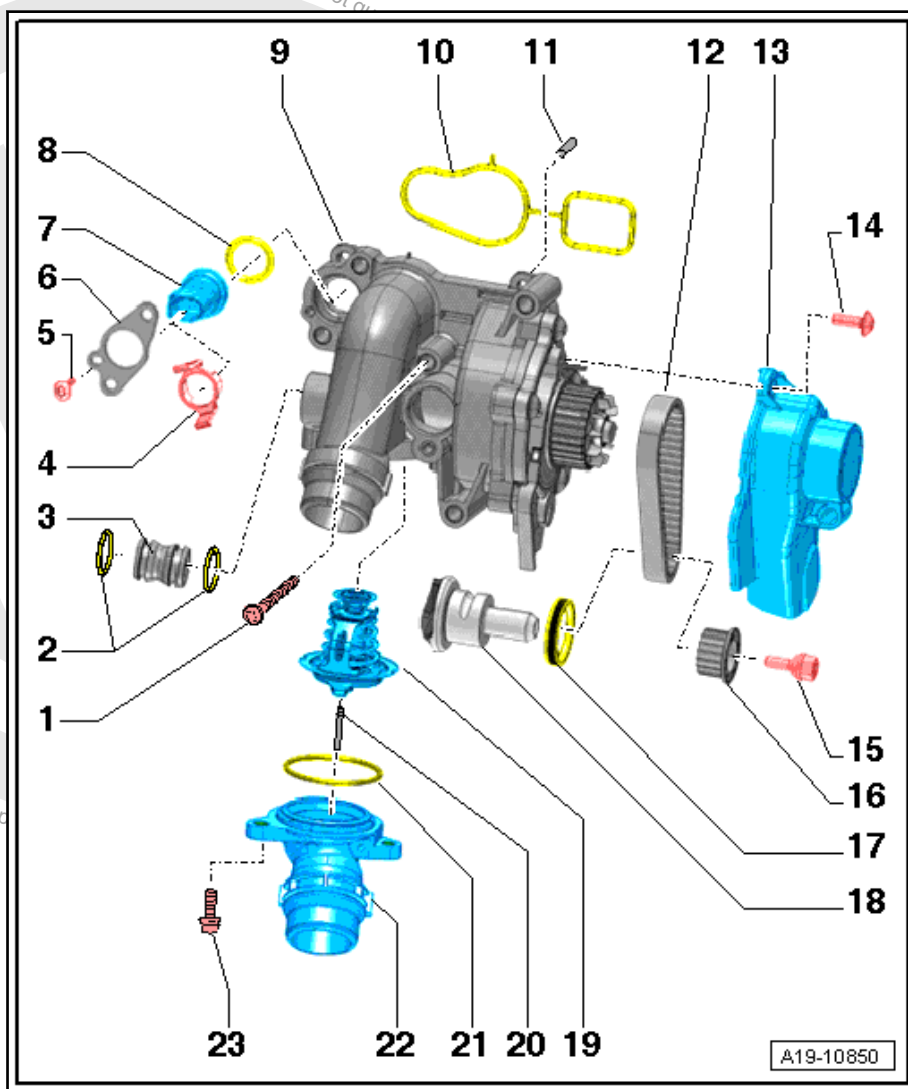
#### 13 - Toothed Belt Guard

#### 14 - Bolt

- ☐ 9 Nm

#### 15 - Bolt

- ☐ 17 Nm
- ☐ Always replace
- ☐ Left-hand thread





#### 16 - Toothed Belt Drive Gear

- ❑ Note the installation position: the collar on the drive gear must face the transmission.

#### 17 - Gasket

- ❑ Replacing. Refer to [⇒ P4.4 ump Drive Gear Sealing Ring, Replacing", page 250](#) .

#### 18 - Balance Shaft

#### 19 - Coolant Thermostat

- ❑ The coolant thermostat can be checked in "Guided Fault Finding" under "Function and Component Selection".
- ❑ Removing and installing. Refer to [⇒ T4.5 hermostat", page 251](#) .
- ❑ Depending on the version Map Controlled Engine Cooling Thermostat -F265-
- ❑ Removing and installing on vehicles with Map Controlled Engine Cooling Thermostat -F265-. Refer to [⇒ P4.2 ump", page 245](#) .

#### 20 - Centering Pin

#### 21 - O-Ring

- ❑ Always replace

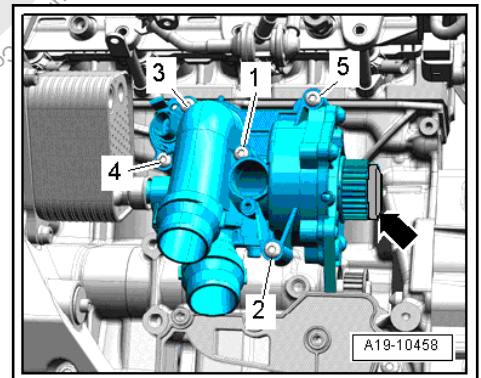
#### 22 - Connection

- ❑ Depending on the version with Map Controlled Engine Cooling Thermostat F265- Identifying feature: connector on the connection

#### 23 - Bolt

- ❑ 9 Nm

#### Coolant Pump Tightening Sequence and Tightening Specification



#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

#### Procedure

- Tighten the coolant pump bolts in the sequence -1 to 5-.
- Tightening specification: 9 Nm.

## 2.4 Overview - Electric Coolant Pump



**1 - Bracket**

**2 - Bolt**

□ 40 Nm

**3 - Coolant Hose**

□ Coolant hose connection diagram. Refer to  
⇒ [D2.1 iagram - Coolant Hoses](#), page 235.

**4 - Coolant Hose**

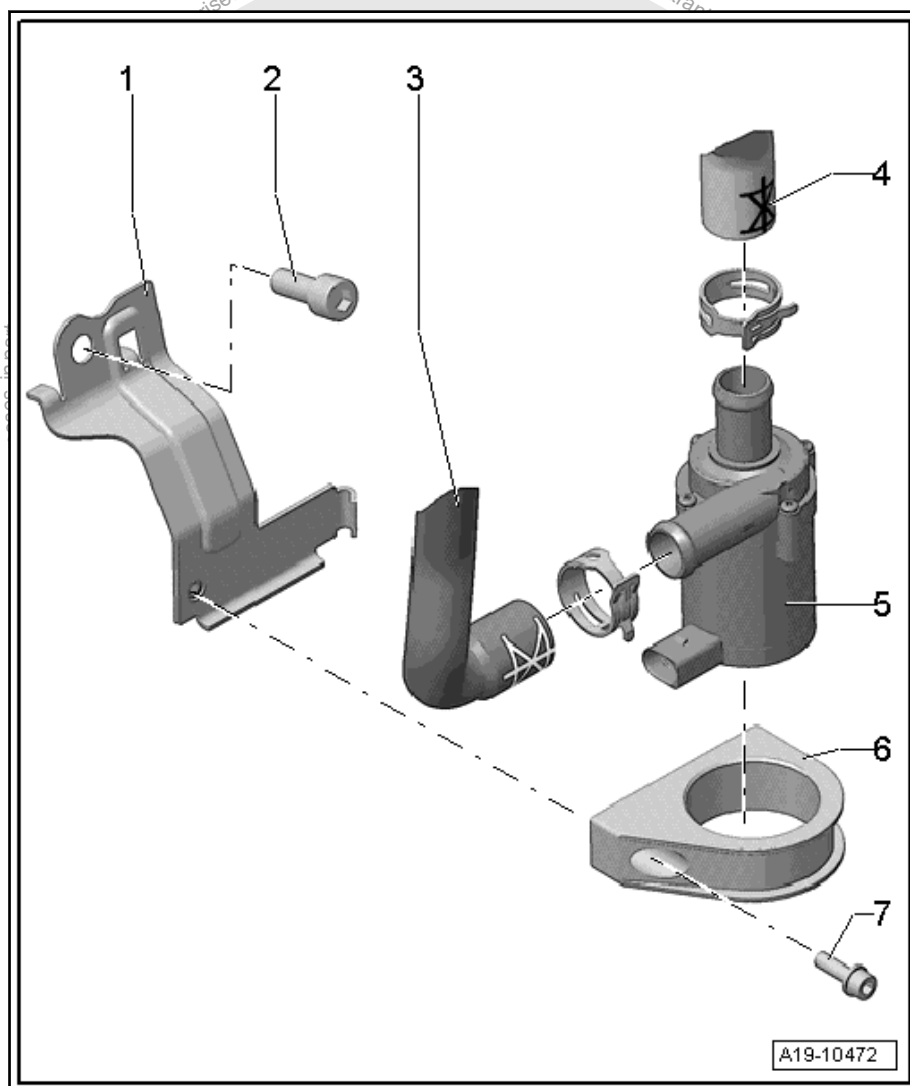
□ Coolant hose connection diagram. Refer to  
⇒ [D2.1 iagram - Coolant Hoses](#), page 235.

**5 - After-Run Coolant Pump  
-V51-**

**6 - Bracket**

**7 - Bolt**

□ 8 Nm



## 2.5 Overview - Radiator/Coolant Fan



# **1 - Coolant Fan -V7-**

- ☐ Removing and installing. Refer to ➤ [C4.1 Coolant Fan V7 and Coolant Fan 2V177](#), page 245.

## **2 - Nut**

- ☐ 10 Nm

## **3 - Fan Shroud**

- ☐ Removing and installing. Refer to ➤ [S4.8 Shroud with Coolant Fan](#), page 259.

## **4 - Lower Coolant Hose**

- ☐ To the connection for the coolant thermostat

## **5 - Clip**

- ☐ Make sure it is secure

## **6 - Engine Coolant Temperature Sensor on Radiator Outlet -G83-**

- ☐ Replace O-ring
- ☐ With O-ring

## **7 - O-Ring**

- ☐ Replace if damaged

## **8 - Upper Coolant Hose**

- ☐ From the coolant pump

## **9 - O-Ring**

- ☐ Replace if damaged

## **10 - Bolt**

- ☐ 5 Nm
- ☐ On the charge air cooler

## **11 - Radiator**

- ☐ Removing and installing. Refer to ➤ [4.10](#), page 264.
- ☐ After replacing replace entire amount of coolant. Refer to ➤ [D1.1 Filling and Filling](#), page 229
- ☐ Engine code CBFA: with Radiator Identification Sensor -G611-. Refer to ➤ [Fig. "Radiator Identification Sensor -G611- \(Engine Code CBFA\)"](#), page 241.

## **12 - Nut**

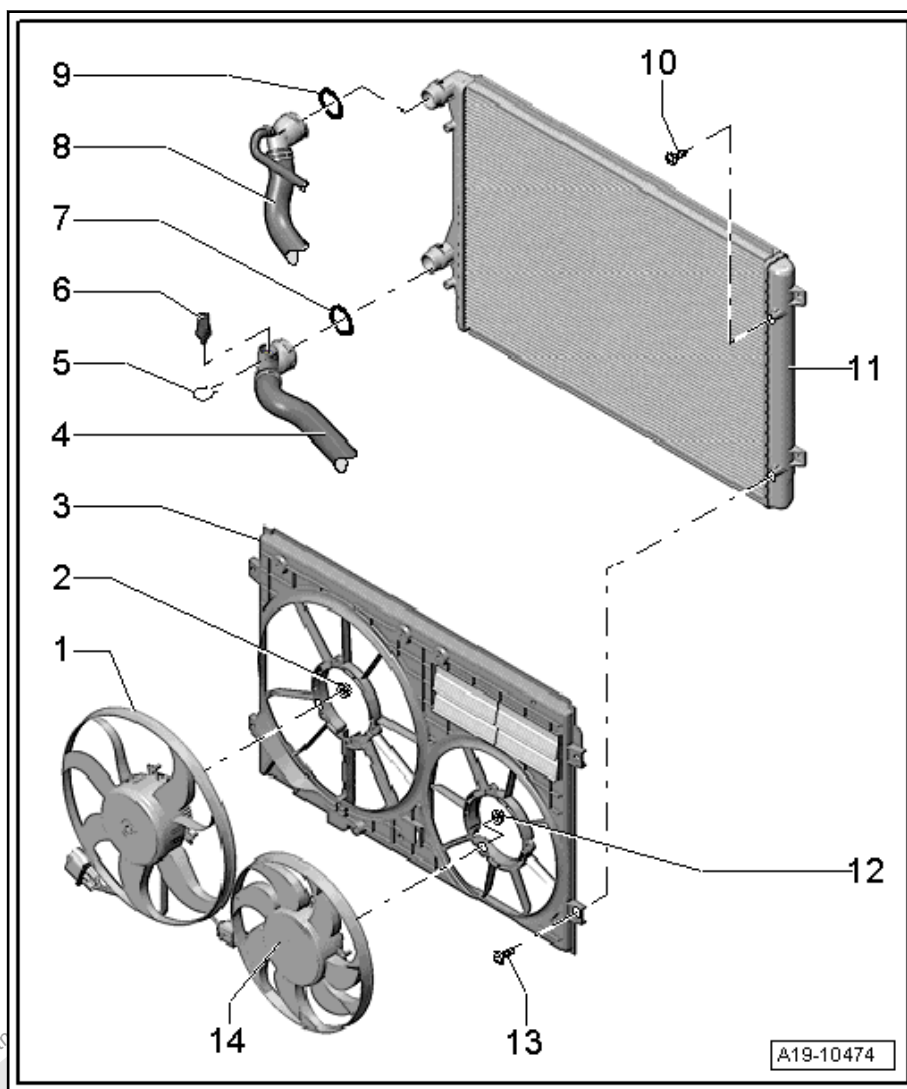
- ☐ 10 Nm

## **13 - Bolt**

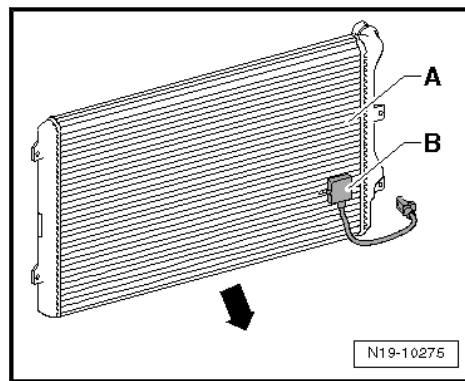
- ☐ 5 Nm
- ☐ On the radiator

## **14 - Radiator Fan 2-V177-**

- ☐ Removing and installing. Refer to ➤ [C4.1 Coolant Fan V7 and Coolant Fan 2V177](#), page 245.



## **Radiator Identification Sensor -G611- (Engine Code CBFA)**



The -arrow- indicates the direction of travel.

A - Radiator

B - Radiator Identification Sensor -G611-



#### Note

*The Radiator Identification Sensor -G611- can be replaced only with the radiator.*





### 3 Diagnosis and Testing

⇒ S3.1 ystem, Checking for Leaks", page 243

#### 3.1 Coolant System, Checking for Leaks

Special tools and workshop equipment required

- ◆ Cooling System Tester -VAG1274B-
- ◆ Cooling System Tester - Adapter -VAG1274/8-
- ◆ Cooling System Tester - Adapter -VAG1274/9-

Test Conditions

- Engine at operating temperature.

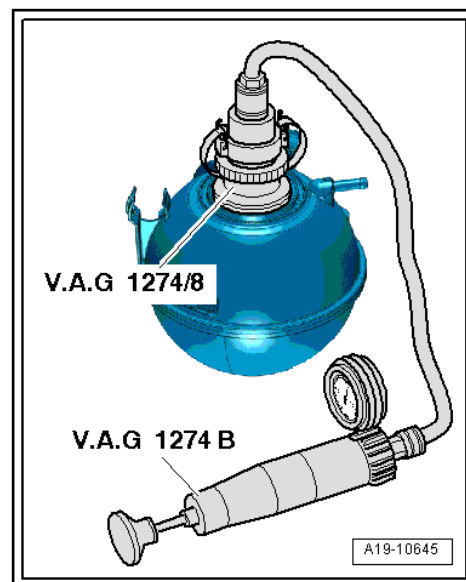
Test Sequence



#### WARNING

*Hot steam may escape when opening the reservoir. Wear protective eyewear and protective clothing to prevent eye injury and scalding. Cover the cap with a cloth and open very carefully.*

- Open cap on coolant expansion tank.
- Install the Cooling System Tester - Adapter -VAG1274/8- in the coolant expansion tank.
- Clamp the Adapter -VAG1274B/1- in the Cooling System Tester - Adapter -VAG1274/8-.
- Connect the Adapter -VAG1274B/1- to the Cooling System Tester -VAG1274B- using the hose provided.



- Generate a pressure of approximately 1.0 bar (14.5 psi) using the hand pump on the Tester.



#### WARNING

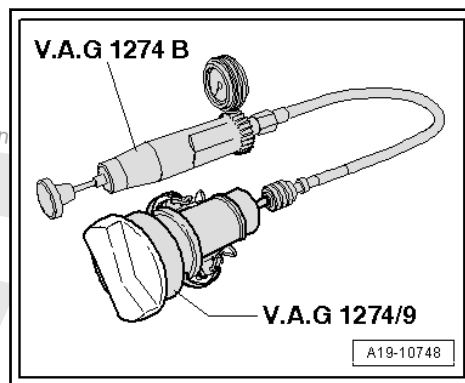
***Risk of scalding! The existing pressure must be reduced before disconnecting the Cooling System Tester -VAG1274B- from the connecting hose or the Adapter -VAG1274B/1-. To do this, press the pressure release valve on the Cooling System Tester -VAG1274B- until the pressure gauge displays the value »0«.***

If the pressure drops:

- Search for leaking areas and repair the malfunction.

#### Pressure Relief Valve in Cap, Checking

- Install the cap in the Cooling System Tester - Adapter - VAG1274/9-.
- Clamp the Adapter -VAG1274B/1- in the Cooling System Tester - Adapter -VAG1274/9-.
- Connect the Adapter -VAG1274B/1- to the Cooling System Tester -VAG1274B- using the hose provided.



- Operate the hand pump.
- The pressure release valve must open at 1.4 to 1.6 bar (20.30 to 23.20 psi).

If the pressure relief valve opens too early or too late:

- Replace cap.





## 4 Removal and Installation

⇒ [C4.1 Coolant Fan V7 and Coolant Fan 2V177", page 245](#)

⇒ [P4.2 ump", page 245](#)

⇒ [P4.3 ump Toothed Belt", page 247](#)

⇒ [P4.4 ump Drive Gear Sealing Ring, Replacing", page 250](#)

⇒ [T4.5 hermostat", page 251](#)

⇒ [C4.6 Coolant Pump", page 254](#)

⇒ [E4.7 engine Coolant Temperature Sensor G62", page 255](#)

⇒ [S4.8 shroud with Coolant Fan", page 259](#)

⇒ [C4.9 Coolant Pipes", page 261](#)

⇒ [4.10", page 264](#)

⇒ [C4.11 Coolant Pipe", page 266](#)

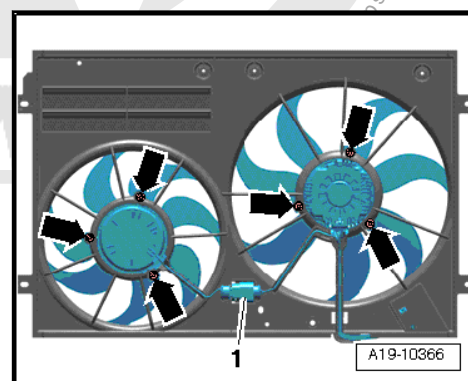
### 4.1 Coolant Fan -V7- and Coolant Fan 2 -V177-

**Special tools and workshop equipment required**

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

**Removing**

- Remove the fan shroud. Refer to [⇒ S4.8 shroud with Coolant Fan", page 259](#).
- Disconnect the connector -1-.



- Free up the electric wires.
- Remove the bolts -arrows- and remove the Coolant Fan.

**Installing**

Install in reverse order of removal.

- ◆ Tightening specification. Refer to [⇒ -2.5 Radiator/Coolant Fan", page 240](#).

### 4.2 Coolant Pump

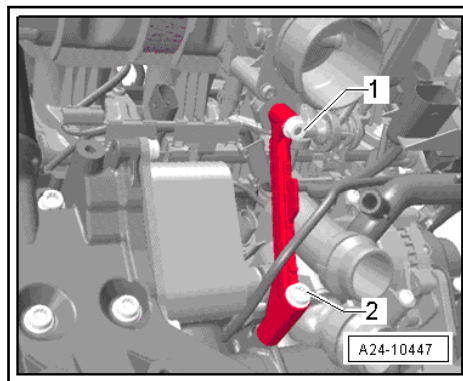
**Special tools and workshop equipment required**

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Coolant Additive -G 12 Plus-Plus-

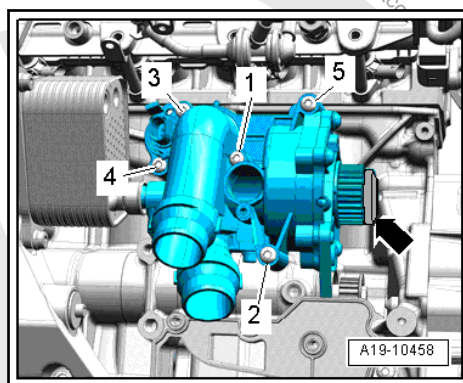


## Removing

- Remove the small coolant pipe. Refer to ➤ [C4.11 Coolant Pipe](#), page 266 .
- Remove the throttle valve control module. Refer to ➤ [T4.10 Throttle Valve Control Module J338](#), page 430 .
- Remove the coolant pump toothed belt. Refer to ➤ [P4.3 Pump Toothed Belt](#), page 247 .
- Remove the nut -1- and bolt -2- and the intake manifold support.



- Remove the bonded rubber bushing for the intake manifold support on the intake manifold.
- Remove the Engine Coolant Temperature Sensor -G62-.  
Inserted version. Refer to ➤ [page 258](#) .  
Threaded version. Refer to ➤ [page 258](#) .
- Remove the bolts -5 through 1-.
- Remove the coolant pump from the centering pin and disconnect it from the engine oil cooler.



## Installing

Install in reverse order of removal. Note the following:



### Note

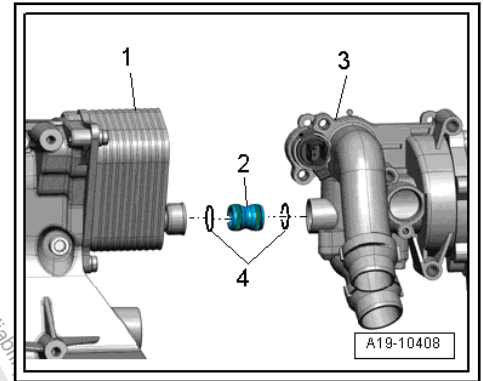
*Replace the seals and the O-rings.*



**NOTICE**

When replacing the coolant pump, ensure the seal, sealing surface and surrounding engine area are free from oils that may contaminate the seal and cause a repeat concern.

- Clean O-ring sealing surfaces.
- Coat the O-rings -4- with Coolant Additive -G 12 Plus-Plus-.



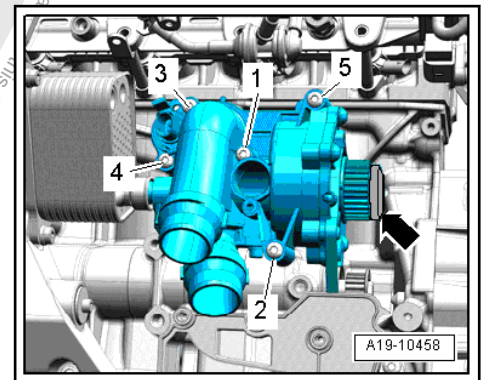
Make sure that both centering pins are installed in the cylinder block if necessary insert.

Install the connection pieces -2- into the engine oil cooler -1-.

First slide the coolant pump -3- onto the connecting piece and then place on the centering pins in the cylinder block.

Using a mirror, check if the coolant pump is »seated« correctly on the centering pins.

Tighten the bolt in the following sequence: -1 to 5-.



**Note**

If a new coolant pump was installed, then the protective cap -arrow- must be removed.

The rest of the installation follows the reverse of the removal procedures.

### 4.3 Coolant Pump Toothed Belt

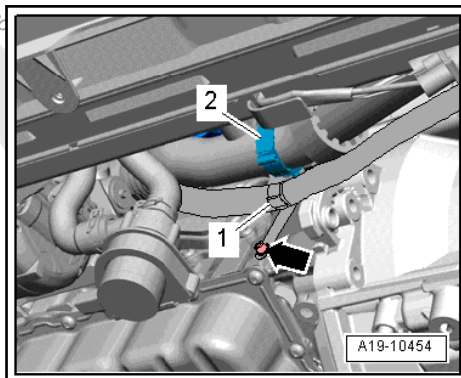
#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 Insert - Ring Wrench - 12mm -T10360-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

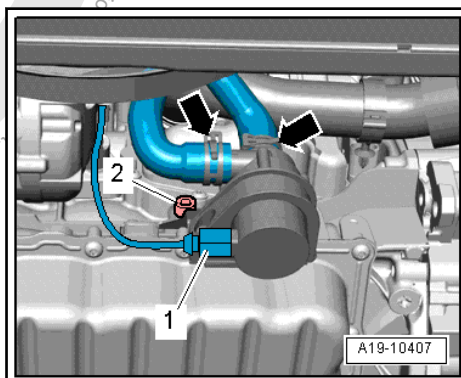


## Removing

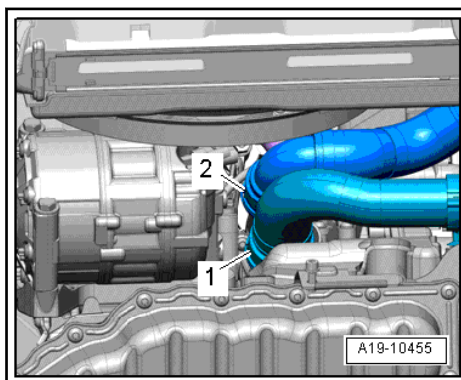
- Remove the small coolant pipe. Refer to ➤ [C4.11 Coolant Pipe](#), page 266.
- Free up the coolant hose -2- and the wiring harness -1-.



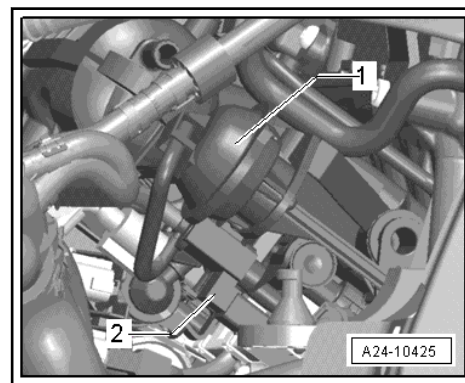
- Remove the bolt -arrow- and remove bracket.
- Remove the bolt -2- on the bracket for the After-Run Coolant Pump -V51-.



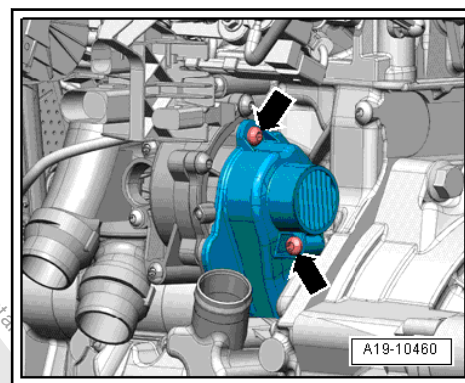
- Remove the coolant hoses -1 and 2- and lay them aside.



- Remove the Intake Manifold Runner Control Valve -N316-2- and set it aside.



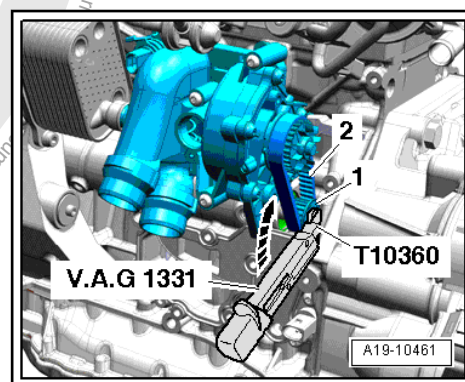
- Free up the wiring harness, pull it upward and secure it with cable ties.
- Remove the bolts -arrows- and remove the toothed belt guard.



#### Caution

***The drive gear bolt has a left-hand thread.***

- Remove the bolt on the coolant pump drive wheel -1- clockwise using the Torque Wrench 1331 5-50Nm -VAG1331- and Torque Wrench 1331 Insert - Ring Wrench - 12mm T10360-. Counterhold the top of the vibration damper with a 24 mm socket when doing this.



- Remove the drive gear -1- and toothed belt -2-.

#### Installing

- Tightening specifications. Refer to ➤ [-2.3 Coolant Pump/Thermostat-, page 237](#) .





Install in reverse order of removal. Note the following:

- Replace the drive gear bolt.
- Replace the seals and O-rings.

Pay attention to the installation position of the drive gear:

- The collar on the drive gear faces the transmission.

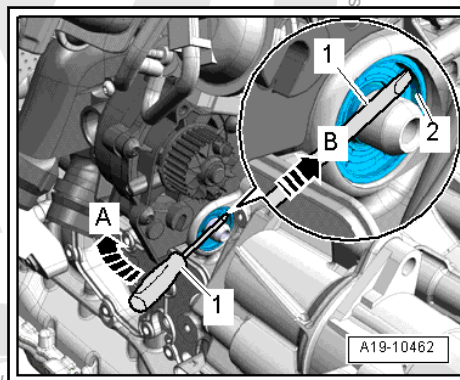
## 4.4 Coolant Pump Drive Gear Sealing Ring, Replacing

**Special tools and workshop equipment required**

- ◆ Seal Installer - Intermediate Shaft -T10353-

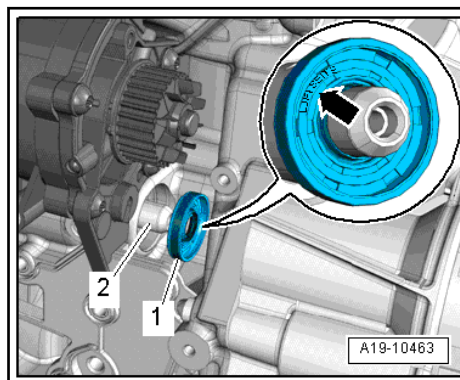
### Removing

- Remove the coolant pump toothed belt. Refer to ➤ [P4.3 ump Toothed Belt](#), page 247.
- Firmly press a screwdriver -1- on the surface of the sealing ring -2- in direction of -arrow B-.
- Pry out the sealing ring in direction of -arrow A-.

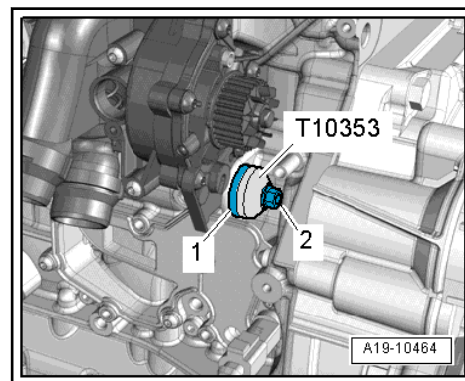


### Installing

- Clean the running and sealing surface.
- Coat the sealing surface of the balance shaft -2- with engine oil.



- Push the sealing ring -1- onto the balance shaft.
- “Luftseite” or (“Outside”) -arrow- must be readable from the outside.
- Mount the Seal Installer - Intermediate Shaft -T10353- on the seal -1- and press it into the cylinder block all the way with the bolt -2-. Do not bend the seal when doing this.



The rest of the installation follows the reverse of the removal procedures.

## 4.5 Coolant Thermostat

### Special tools and workshop equipment required

- ◆ Hex Ball Socket -T10058-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Coolant additive -G 12 plus-plus-

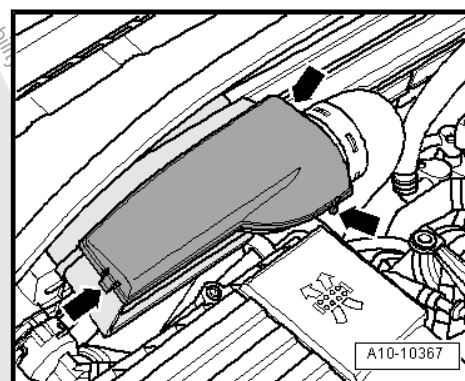


### Note

*On vehicles with map controlled engine the coolant pump must be removed in order to remove the Map Controlled Engine Cooling Thermostat -F265- (coolant thermostat). Refer to ➤ [P4.2 ump](#), page 245.*

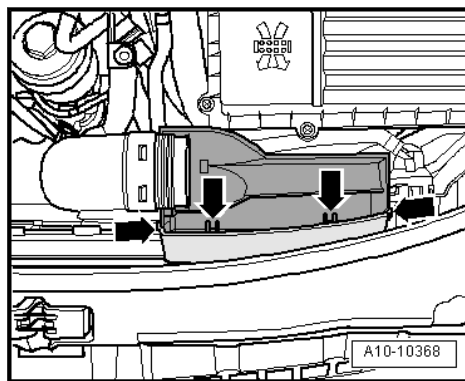
### Removing

- Drain the coolant. Refer to ➤ [D1.1 draining and Filling](#), page 229.
- Disengage the side clips -arrows- and remove the cover for the air duct.

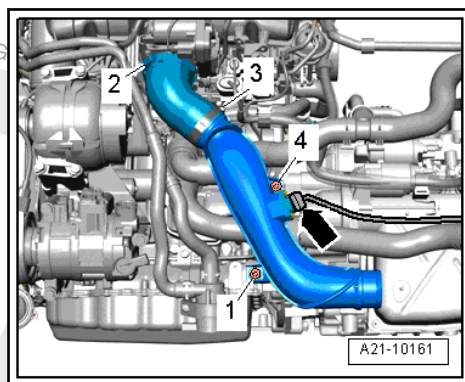


- Disengage the wire retainers -arrows- to unclip the lower air duct.

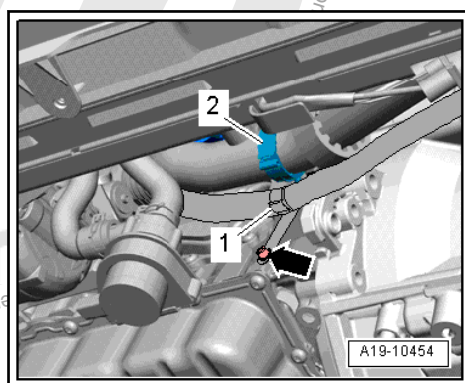




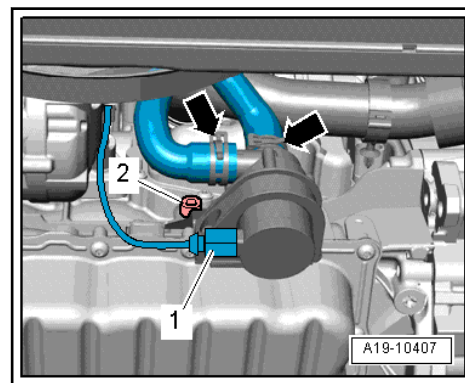
- Remove both the lower air guide and the air guide hose.
- If equipped, remove the charge air guide to the sound generator.
- Loosen the hose clamp -2-.



- Remove the bolt -4-.
- Disconnect the connector -arrow-.
- Remove the bolt -1- and remove the air guide pipe downward.
- Free up the coolant hose -2- and the wiring harness -1-.



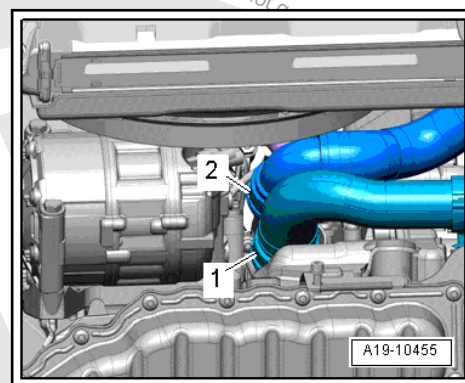
- Remove the bolt -arrow- and remove bracket.
- Remove the bolt -2- on the bracket for the After-Run Coolant Pump -V51-.



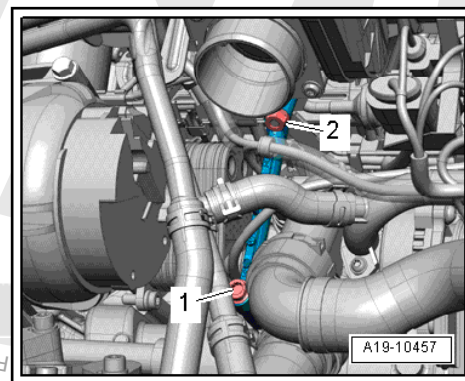
#### Note

*The After-Run Coolant Pump -V51- stays in the installed position.*

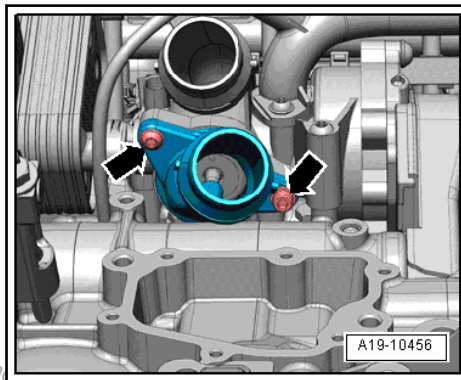
- Remove the coolant hoses -1 and 2- and lay them aside.



- Loosen the nut -2-, remove the bolt -1- and move the support for the intake manifold to the right.



- Remove the oil separator. Refer to ➤ [S4.7 eparator](#)", page [223](#) .
- Remove bolts -arrows- and remove connecting pieces. For the right bolt, the Hex Ball Socket -T10058- is useful.
- Remove the coolant thermostat.

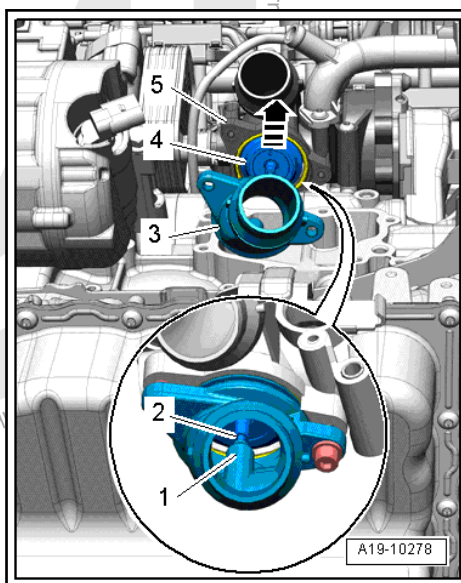


### Installing

- ◆ Tightening specifications: Refer to ⇒ [-2.3 Coolant Pump/Thermostat](#), page 237.

Install in reverse order of removal. Note the following:

- Replace the seals and O-rings.
- Clean the sealing surface on the O-ring.
- Coat the O-ring with Coolant Additive -G 12 plus-plus-.
- Install the thermostat -4- into the housing -5- for the coolant pump and move it slightly forward in direction of -arrow-.



- Carefully mount the connector -3-, while doing so, insert the centering pin -2- into the guide -1-.



### Note

*Depending on the version a coolant thermostat can be installed without a centering pin.*

## 4.6 Electric Coolant Pump

### Special tools and workshop equipment required

- ◆ Hose Clamps - Up To 25 mm -3094-
- ◆ Spring Clip Pliers



## Removing

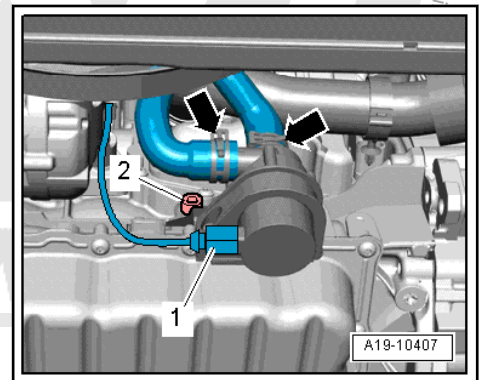


### WARNING

***Risk of scalding due to hot steam and hot coolant:***

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective eyewear and protective clothing to prevent eye injury and scalding.***
- ◆ ***Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.***

- Open cap on coolant expansion tank.
- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the connector -1- for the After-Run Coolant Pump -V51-.



- Place a Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray - VAS6208- under the engine.
- Clamp off the coolant hoses -arrows- with the Hose Clamps - Up To 25mm -3094-.
- Remove the coolant hoses from the After-Run Coolant Pump -V51-.
- Remove the bolt -2- and the After-Run Coolant Pump -V51-.

## Installing

- ◆ Tightening specification. Refer to ➔ [-2.4 Electric Coolant Pump-, page 239](#)

Install in reverse order of removal. Note the following:

- Check the coolant level. Refer to ➔ [D1.1 raining and Filling-, page 229](#).

## 4.7 Engine Coolant Temperature Sensor - G62-

### Special tools and workshop equipment required

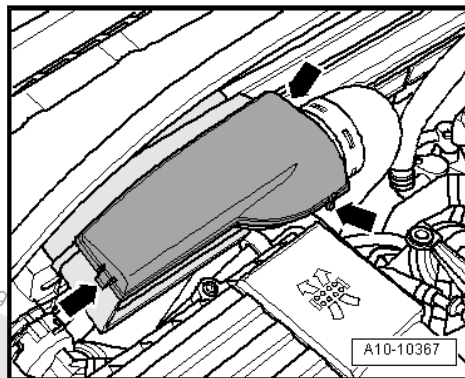
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ \



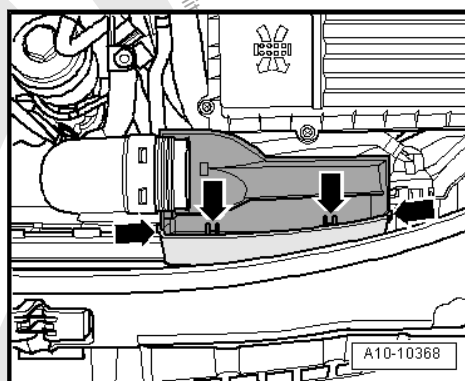
## Removing

### Conditions

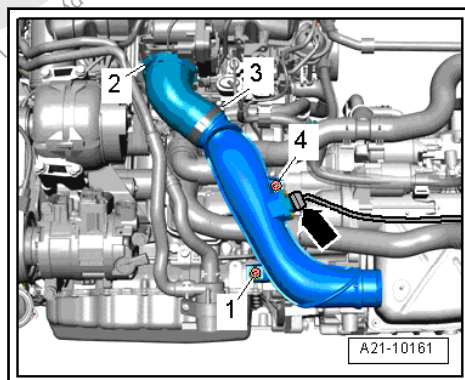
- The engine is cold.
- Disengage the side clips -arrows- and remove the cover for the air duct.



- Disengage the wire retainers -arrows- to unclip the lower air duct.



- Remove both the lower air guide and the air guide hose.
- If equipped, remove the charge air guide to the sound generator.
- Loosen the hose clamp -2-.

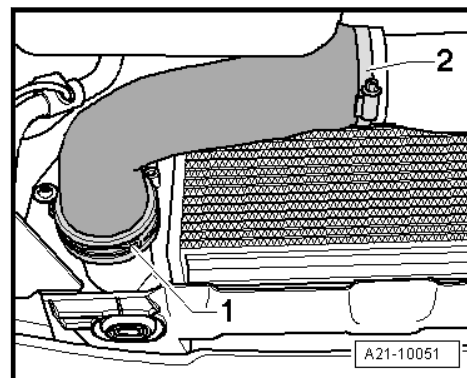


- Remove the bolt -4-.
- Disconnect the connector -arrow-.
- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.

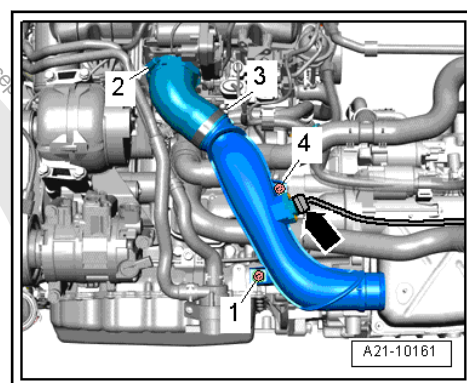




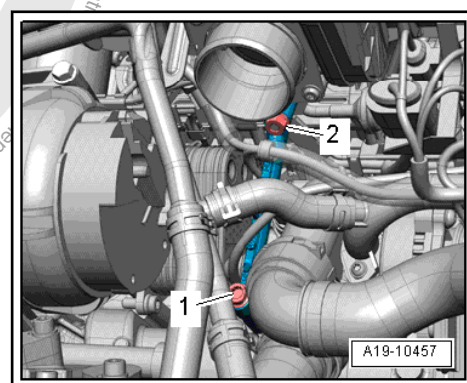
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



- Seal off the connections on the charge air cooler with a clean cloth.
- Remove the bolt -1- and remove the air guide pipe downward.

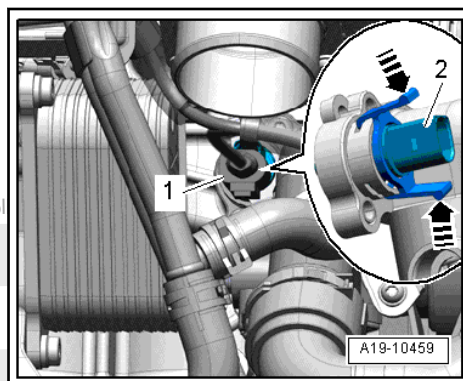


- Remove the throttle valve control module. Refer to [T4.10 Throttle Valve Control Module J338](#), page 430.
- Remove the intake manifold support by removing the nut -2- and bolt -1-.





## Engine Coolant Temperature Sensor -G62- with Clip



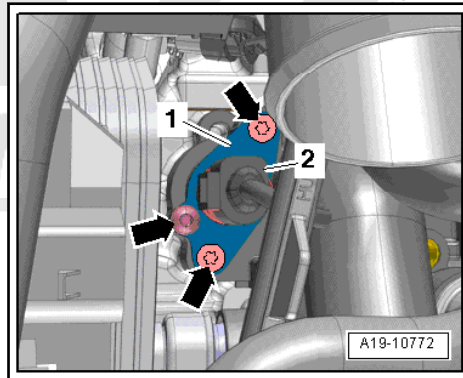
- Disconnect the connector -1- on the Engine Coolant Temperature Sensor - G62-.
- Press the locking mechanisms in direction of -arrows- and remove the clip.
- Remove the Engine Coolant Temperature Sensor -G62- -2-.



### Note

*To prevent a lot of coolant loss, immediately insert the new Engine Coolant Temperature Sensor -G62- with an O-ring in the connection.*

Engine Coolant Temperature Sensor -G62- with retaining plate:



- Disconnect the connector -2- on the Engine Coolant Temperature Sensor -G62-.
- Remove the bolts -arrows- and remove the retaining plate -1-.
- Remove the Engine Coolant Temperature Sensor -G62-.



### Note

*To prevent a lot of coolant loss, immediately insert the new Engine Coolant Temperature Sensor -G62- with an O-ring in the connection.*

## Installing

Tightening specifications:

- ♦ Refer to ➤ [-2.3 Coolant Pump/Thermostat](#), page 237 .





◆ Refer to ➤ [-2.5 Intake Manifold](#)", page 393 .

Install in reverse order of removal. Note the following:



#### Note

*Replace the O-ring.*

- Clean the sealing surface on the O-ring.
- Check the coolant level. Refer to ➤ [D1.1 raining and Filling](#)", page 229 .

## 4.8 Fan Shroud with Coolant Fan

Special tools and workshop equipment required

◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

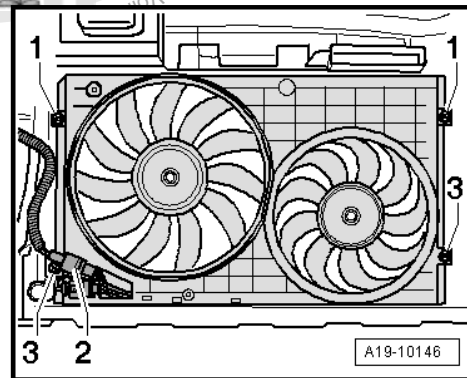


#### Caution

*The charge air pipe clamps must be tightened to 5.5 Nm. An insufficient or excessive tightening torque can cause the charge air hose to come off the charge air pipe while driving.*

#### Removing

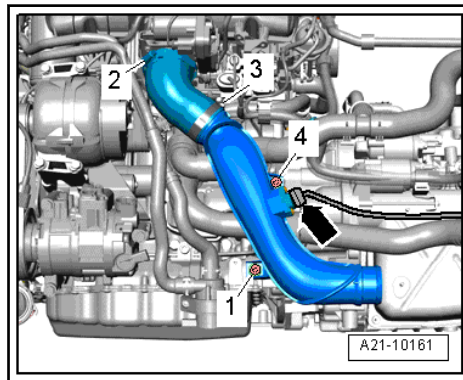
- Remove the bolts -1- from the top.



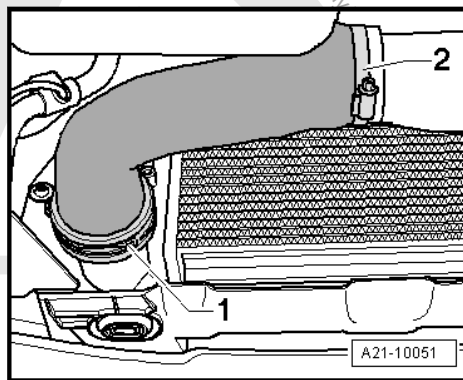
#### Note

*The left bolt is under the coolant connector.*

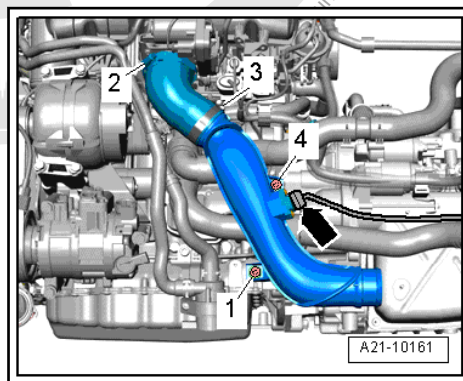
- If equipped, remove the charge air guide to the sound generator.
- Loosen the hose clamp -2-.



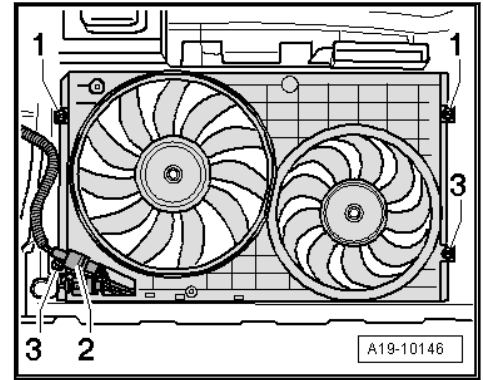
- Remove the bolt -4-.
- Disconnect the connectors -arrow- and free up the electric wire.
- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



- Seal off the connections on the charge air cooler with a clean cloth.
- Remove the bolt -1- and remove the air guide pipe downward.



- Disconnect the connector -2-.
- Remove the bolts -3- and remove the fan shroud downward.



### Installing

Install in reverse order of removal. Note the following:

- ◆ Tightening specification. Refer to ➤ [-2.5 Radiator/Coolant Fan”, page 240](#) .
- Install the air ducts with connector coupling. Refer to ➤ [C1.1 onnections with Connector Couplings; Assembling”, page 348](#) .

## 4.9 Front Coolant Pipes

### Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Spring Clip Pliers
- ◆ Coolant Additive -G 12 plus-plus-

### Removing



#### WARNING

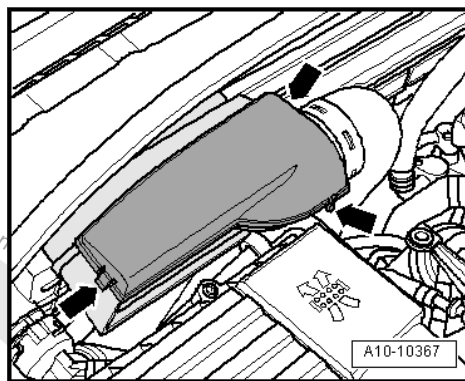
***Risk of scalding due to hot steam and hot coolant:***

- ◆ ***The coolant system is under pressure when the engine is warm.***
- ◆ ***Wear protective eyewear and protective clothing to prevent eye injury and scalding.***
- ◆ ***Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.***

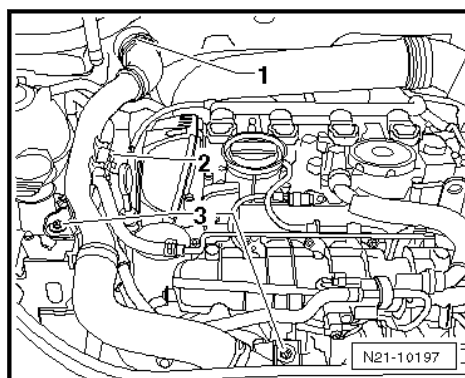
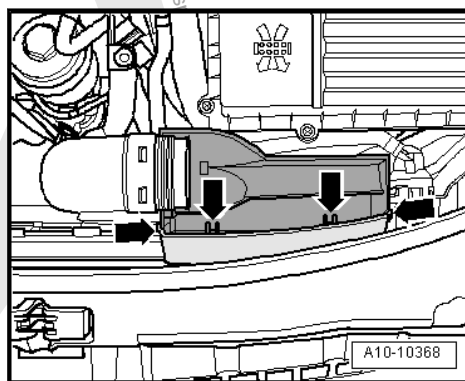
- Open cap on coolant expansion tank.
- Disengage the side clips -arrows- and remove the cover for the air duct.



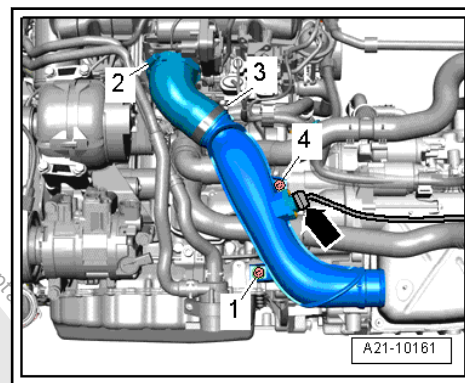
- Disengage the wire retainers -arrows- to unclip the lower air duct.



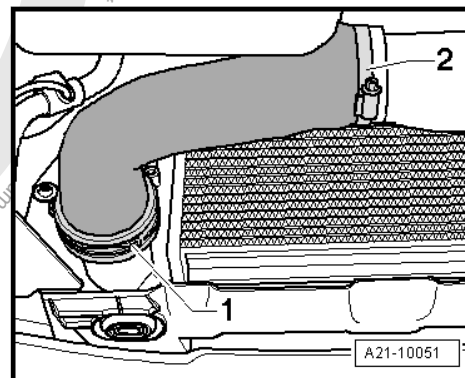
- Remove both the lower air guide and the air guide hose.
- Vehicles with sound generator: open the locking mechanism -1-, unclip the fuel lines -2- and loosen the bolt -3- on the Evaporative Emission (EVAP) canister. Move the charge air pipe aside.



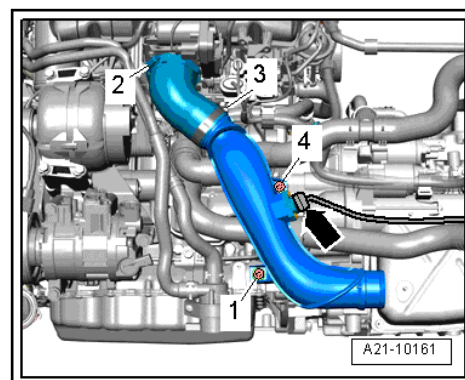
- Loosen the hose clamp -2-.



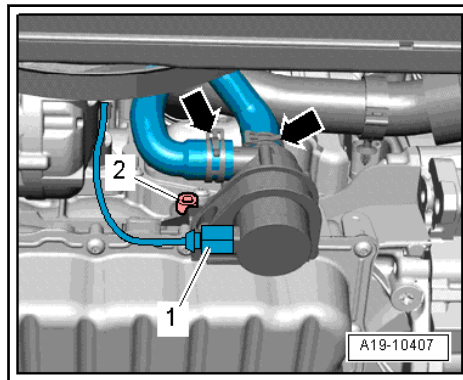
- Remove the bolt -4-.
- Disconnect the connectors -arrow- and free up the electric wire.
- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



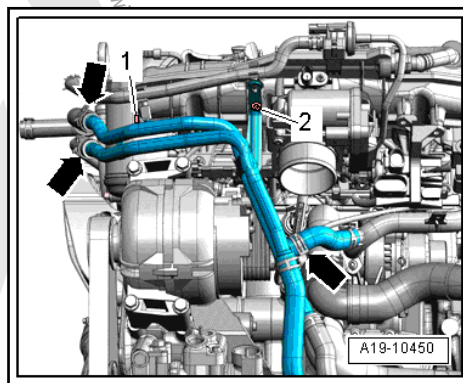
- Seal off the connections on the charge air cooler with a clean cloth.
- Remove the bolt -1- and remove the air guide pipe downward.



- Place a Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray - VAS6208- under the engine.



- Remove the coolant hoses from the After-Run Coolant Pump -V51- -arrows-.
- Remove the bolts -1 and 2- and remove the front coolant pipes from the coolant hoses -arrows-.



### Installing

- ◆ Tightening specifications. Refer to [⇒ -2.2 Coolant Pipes”, page 236](#).

Install in reverse order of removal. Note the following:

- ◆ Install only approved clamps for securing hose connections. Refer to the Parts Catalog.
- Install the air ducts with connector coupling. Refer to [⇒ C1.1 onnections with Connector Couplings, Assembling”, page 348](#).
- Check the coolant level. Refer to [⇒ D1.1 raining and Filling”, page 229](#).

## 4.10 Radiator

### Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

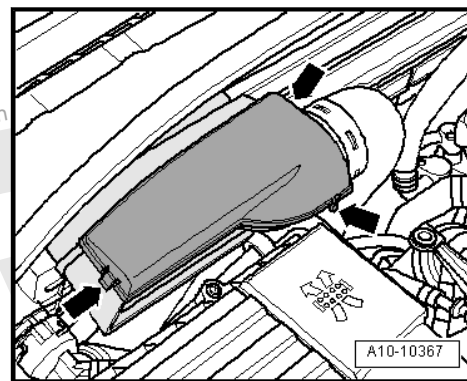
### Removing

- Drain the coolant. Refer to [⇒ D1.1 raining and Filling”, page 229](#).
- Disengage the side clips -arrows- and remove the cover for the air duct.

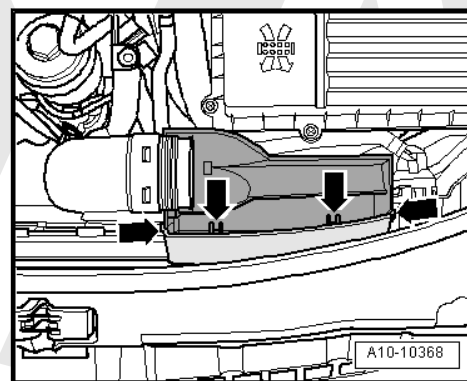




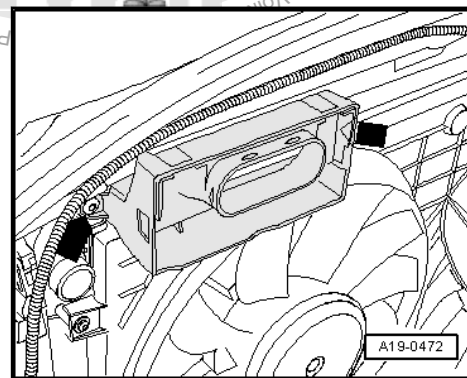
- Disengage the wire retainers -arrows- to unclip the lower air duct.



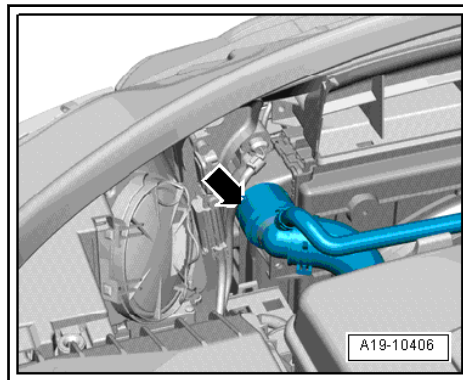
- Detach the air duct at the lock carrier -arrows- and remove the air duct.



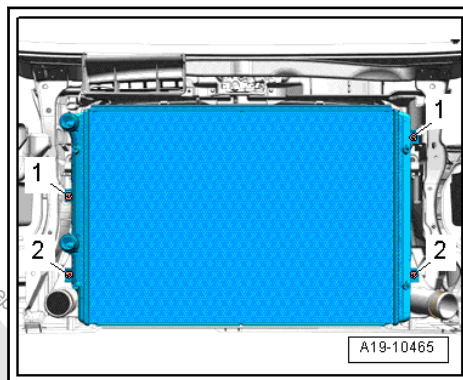
- Remove both the lower air guide and the air guide hose.
- Remove the fan shroud. Refer to [⇒ S4.8 hroud with Coolant Fan", page 259](#) .
- Remove the upper coolant hose -arrow- from the radiator.







- Remove the bolts -1 and 2- and remove the radiator.



### Installing

Install in reverse order of removal. Note the following:

- ◆ Tightening specification. Refer to [⇒ -2.5 Radiator/Coolant Fan”, page 240](#).
- Check the coolant level. Refer to [⇒ D1.1 raining and Filling”, page 229](#).

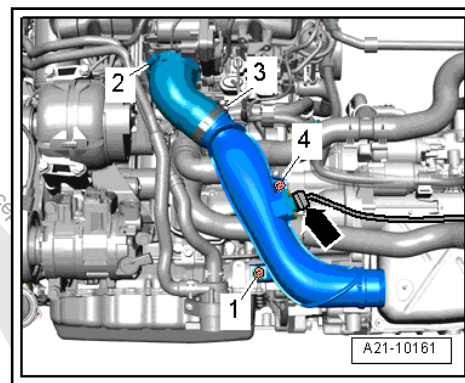
## 4.11 Small Coolant Pipe

### Special tools and workshop equipment required

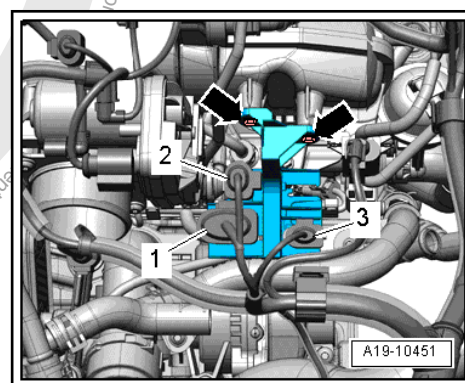
- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Spring Clip Pliers
- ◆ Coolant Additive -G 12 plus-plus-

### Removing

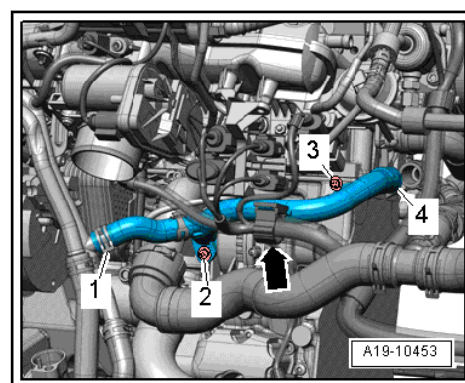
- Drain the coolant. Refer to [⇒ D1.1 raining and Filling”, page 229](#).
- Remove the air filter. Refer to [⇒ F4.2 ilter Housing”, page 404](#).
- If equipped, remove the charge air guide to the sound generator.
- Loosen the hose clamp -2-.



- Remove the bolt -4-.
- Disconnect the connector -arrow-.
- Remove the bolt -1- and remove the air guide pipe downward.
- Remove the bolts -arrows- and remove the electrical connectors -1 through 3- from the bracket.



- Free up the wiring harness on the small coolant pipe -arrow-.
- Remove the bolts -2 and 3-.
- Disconnect the small coolant pipe from the coolant pump and from the coolant hoses -1 and 4-.



## Installing

- Tightening specifications. Refer to ➤ [-2.2. Coolant Pipes-](#), [page 236](#).

Install in reverse order of removal. Note the following:



#### Note

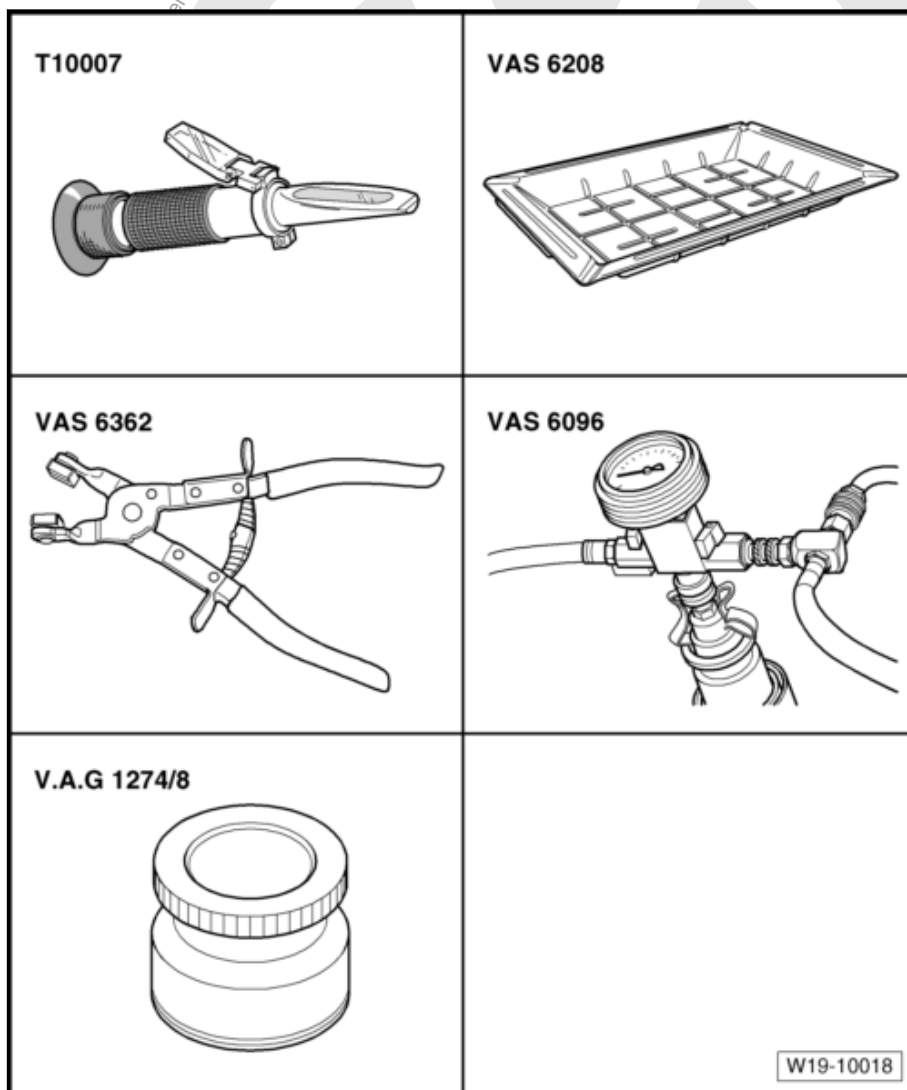
- ◆ *Replace the O-ring.*
- ◆ *Install only approved clamps for securing hose connections.  
Refer to the Parts Catalog.*
- Install the air ducts with connector coupling. Refer to ➤  
[C1.1 onnections with Connector Couplings, Assembling](#)”,  
[page 348](#) .
- Check the coolant level. Refer to ➤ [D1.1 raining and Filling](#)”,  
[page 229](#) .





## 5 Special Tools

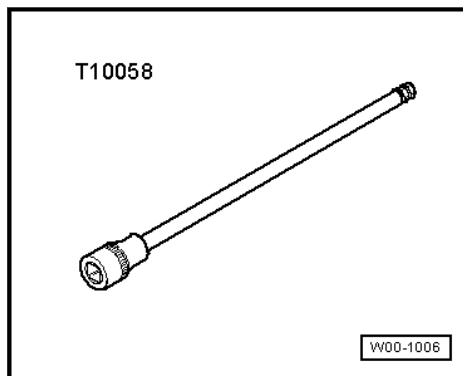
Special tools and workshop equipment required



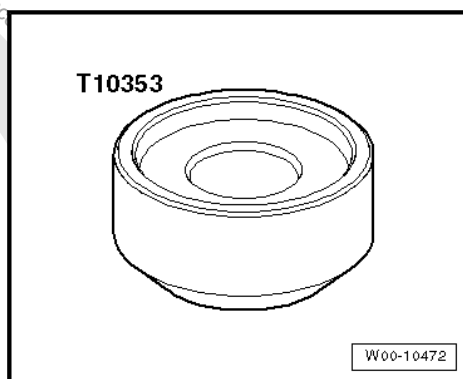
- ◆ Refractometer -T10007A-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-
- ◆ Spring Clip Pliers
- ◆ Cooling System Charge Kit -VAS6096-
- ◆ Cooling System Tester - Adapter -VAG1274/8-
- ◆ Coolant Additive -G 12 plus-plus-



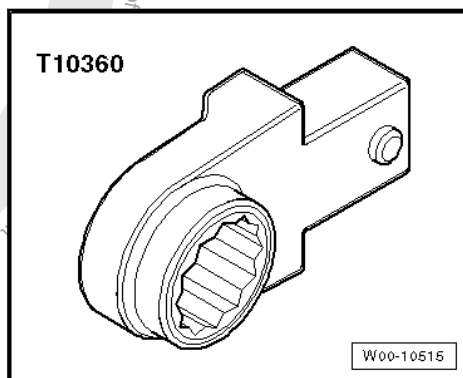
◆ Hex Ball Socket -T10058-



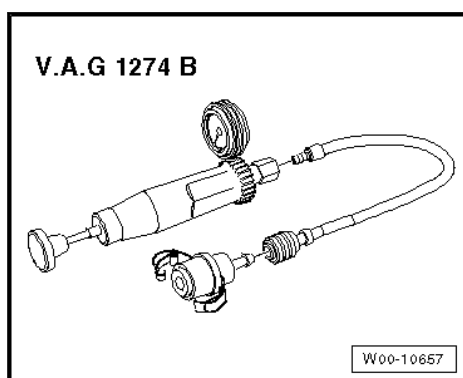
◆ Seal Installer - Intermediate Shaft -T10353-



◆ Torque Wrench 1331 Insert - Ring Wrench - 12mm -T10360-

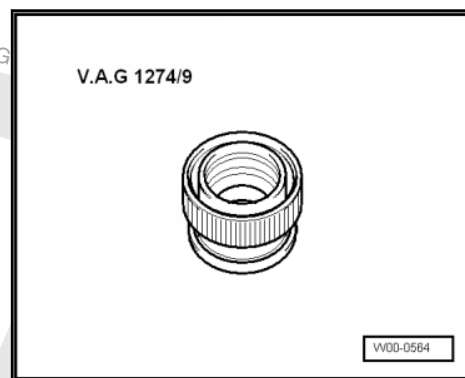


◆ Cooling System Tester -VAG1274B-

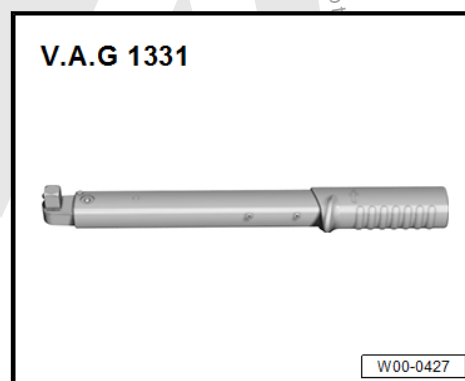




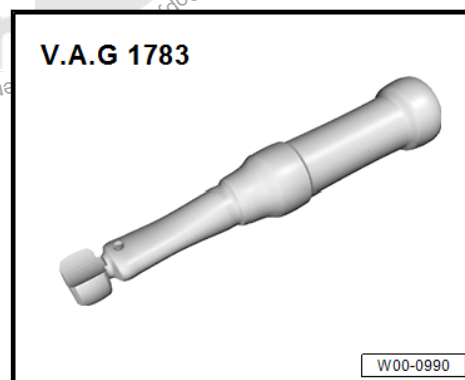
◆ Cooling System Tester - Adapter -VAG1274/9-



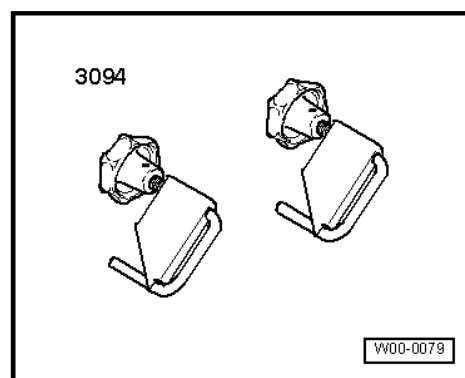
◆ Torque Wrench 1331 5-50Nm -VAG1331-



◆ Torque Wrench 1783 - 2-10Nm -VAG1783-



◆ Hose Clamps - Up To 25 mm -3094-





## 20 – Fuel Supply

### 1 General Information

⇒ [T1.1 ank, Draining", page 272](#)

#### 1.1 Fuel Tank, Draining

⇒ [T1.1.1 ank, Draining with Fuel Pump Installed", page 272](#)

⇒ [t1.1.2 he Fuel Tank, and if Fuel Pump is Defective", page 274](#)

##### 1.1.1 Fuel Tank, Draining with Fuel Pump Installed

###### Special tools and workshop equipment required

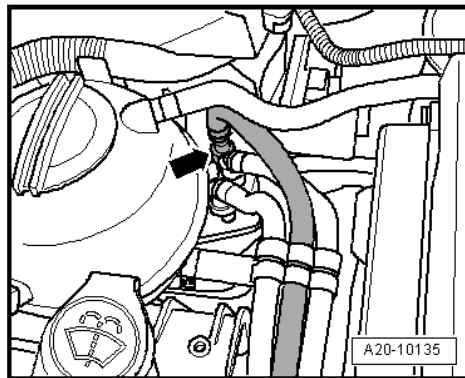
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Fuel Extraction Unit -VAS5190-
- ◆ Wrench - Fuel Sending Unit -T10202-
- ◆ Fuel Extraction - Adapter 3 -VAS5190/3-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-
- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- Read the safety precautions before starting. Refer to ⇒ [P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to ⇒ [f1.1 or Clean Working Conditions", page 1](#) .



###### WARNING

- ◆ *The fuel supply line is under pressure. Always wear protective eyewear and protective clothing to prevent injuries and contact with skin. Place a cleaning cloth around the connection point before loosening hose connections. Remove the hose connection carefully to reduce the pressure.*
- ◆ *Connect the Fuel Extraction Unit -VAS5190- ground strap with the ground.*

- Disconnect fuel supply line -arrow-. To do so, press in securing ring.

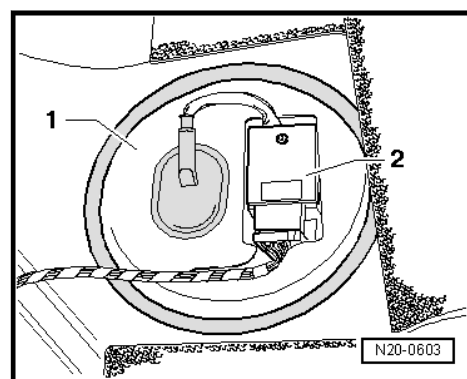
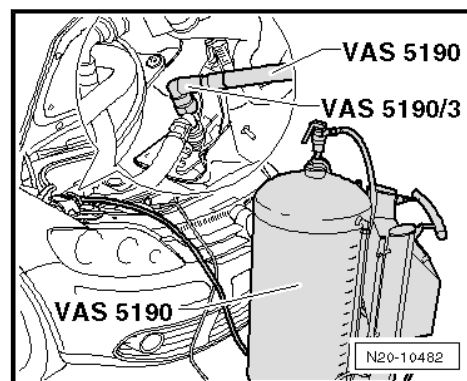


- Connect the Fuel Extraction Unit -VAS5190- and Fuel Extraction - Adapter 3 -VAS5190/3- to the fuel supply line.

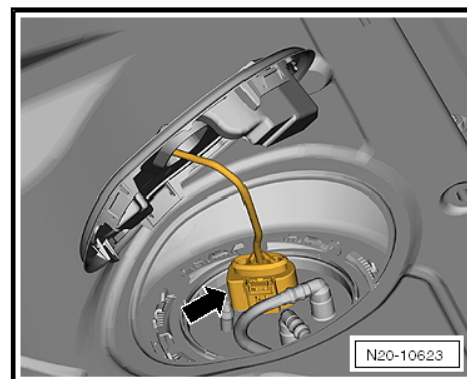




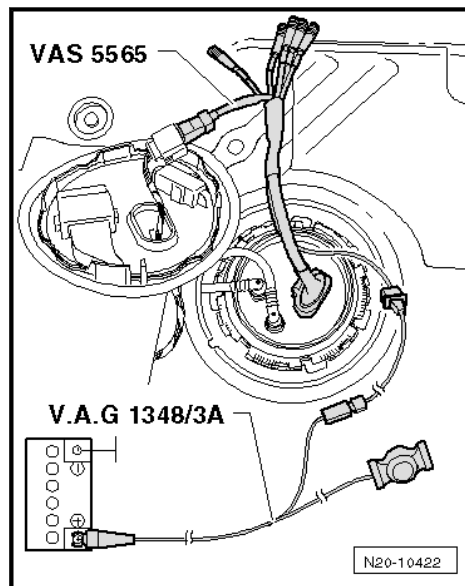
- Remove the bench seat. Refer to ⇒ Body Interior; Rep. Gr. 72; Removal and Installation.
- Remove the cover -1- and Fuel Pump Control Module -J538-2- from the fuel delivery unit.



- Disconnect the connector -arrow-.



- Attach the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565- to the connector and to the fuel delivery unit.



- Connect the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A- to the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565- and battery positive (+).



#### Note

*This step allows the fuel pump to run when the engine is not running.*

- Remove the cap from the fuel filler tube.
- Operate the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A- and the shut-off valve on the Fuel Extraction Unit -VAS5190- until the fuel tank is empty.



#### Caution

***Do not run the fuel pump when it is »dry«.***

### 1.1.2 Draining the Fuel Tank, and if Fuel Pump is Defective

#### Special tools and workshop equipment required

- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Fuel Extraction Unit -VAS5190-
- ◆ Wrench - Fuel Sending Unit -T10202-
- Read the safety precautions before starting. Refer to [P1.2 recautions](#), [page 2](#).
- Follow all the guidelines for clean working conditions. Refer to [f1.1 or Clean Working Conditions](#), [page 1](#).



#### Note

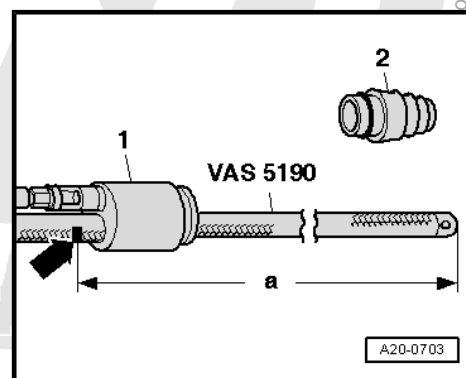
- ◆ Vehicles with engine code CBFA have a bayonet connection.
- ◆ The fuel tank has a check valve installed. Be careful not to damage this check valve while extracting fuel.



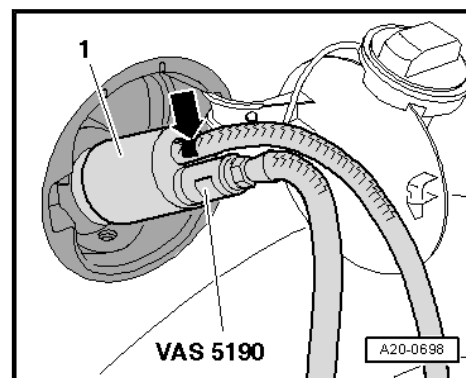
#### Caution

**Secure the Fuel Extraction Unit -VAS5190- Ground (GND) wire to a bare area of the chassis.**

- Remove the cone piece -2- from the shaft piece -1- on the Fuel Extraction Unit -VAS5190-.



- Using insulating tape, apply a mark -arrow- on hose at the distance -a- = 1500 mm from end of suction hose.
- Remove the cap from the fuel filler tube.
- Attach the shaft piece -1- from the Fuel Extraction Unit -VAS5190- to the fuel tank filler tube.



- Push the extractor hose into the fuel tank until it reaches the mark previously made on the shaft piece -arrow- and extract the fuel. Refer to the Fuel Extraction Unit - VAS5190- Operating Instructions.



#### Note

*Fuel tank is drained almost completely.*




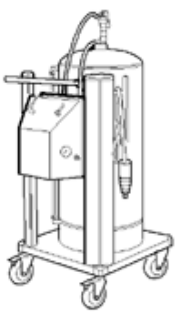
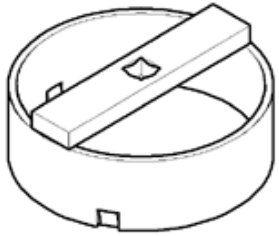
#### Caution

*Do not use force to pull the extractor hose if it gets stuck on the check valve.*

- ◆ *In this case, remove the fuel delivery unit and manually hold the check valve open. When doing this, make sure the arm does not come in contact with the fuel.*

### 1.1.3 Draining the fuel tank, and if fuel pump is defective, engine codes CAWB and CCZA

#### Special tools and workshop equipment required

<b>V.A.G 1332</b> 	<b>VAS 5190</b> 
<b>T10202</b> 	

I20-0003

- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Fuel Extraction Unit -VAS5190-
- ◆ Wrench - Fuel Sending Unit -T10202-
- Read the safety precautions before starting. Refer to [P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to [f1.1 or Clean Working Conditions", page 1](#) .

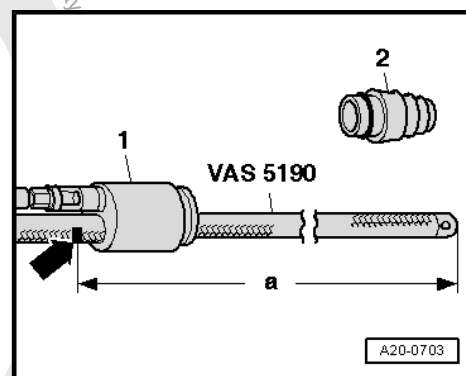


### Caution

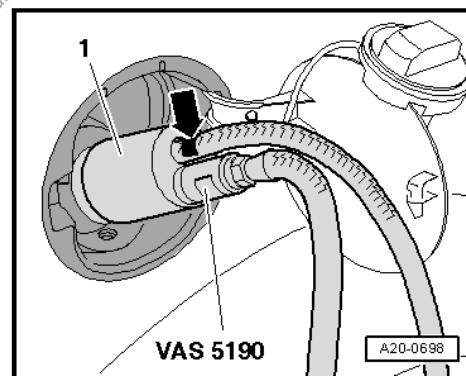
**Secure the Fuel Extraction Unit -VAS5190- ground wire to a bare area of the chassis.**

### Fuel Tank, Draining When More than $\frac{3}{4}$ Full

- Remove the cone piece -2- from the shaft piece -1- on the Fuel Extraction Unit -VAS5190-.



- Using insulating tape, apply a mark on the hose -arrow- -a- = 1,180 mm from the end of the suction hose.
- Remove the cap from the fuel filler tube.

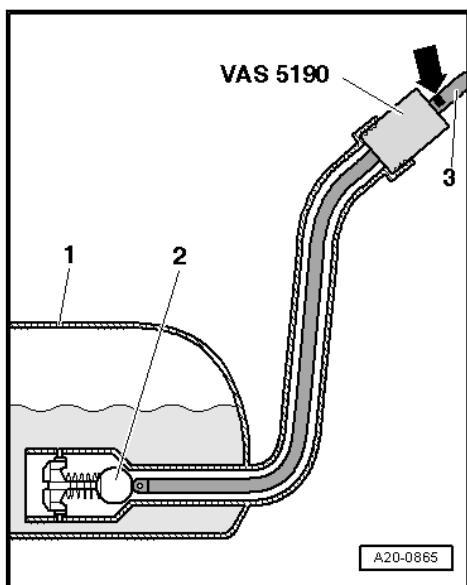


- Attach the shaft piece -1- from the Fuel Extraction Unit -VAS5190- to the fuel tank filler tube.
- Slide the suction hose as far into fuel tank until the mark applied earlier -arrow- stands on shaft piece.



#### Note

*There is a ball valve -2- located at the lower end of the filler neck in the fuel tank -1- that must not be damaged by the suction hose -3-. Therefore slide in hose only up to the marking -arrow- applied earlier.*



- Drain the fuel tank as much as possible.
- Carefully pull out the suction hose.

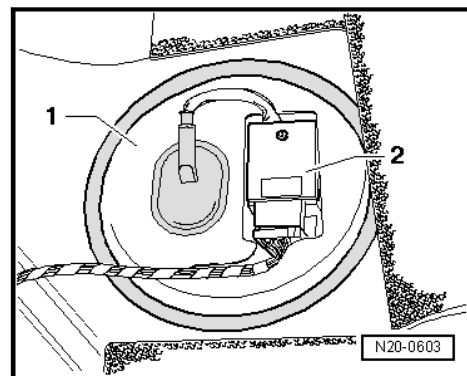


#### Note

- ◆ *When no more fuel can be extracted, the tank is emptied only enough for the fuel delivery unit to be removed without any danger.*
- ◆ *If fuel tank must be drained completely, proceed as follows:*

#### Fuel Tank, Draining When Less Than $\frac{3}{4}$ Full

- Switch off the ignition and all electrical consumers and remove the key.
- Remove the bench seat. Refer to ➔ Body Interior; Rep. Gr. 72; Rear Seats; Rear Seat Backrest, Removing and Installing.
- Unclip the cover -1- with the Fuel Pump Control Module -J538- -2-.

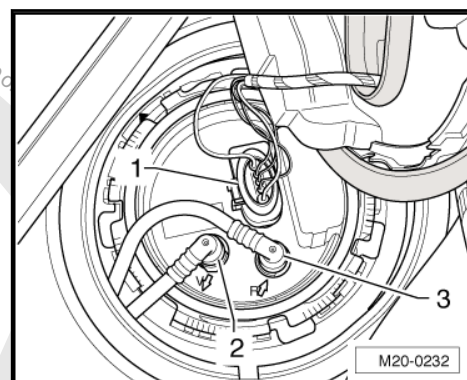


# **WARNING**

*The fuel system is under pressure!*

- ◆ *Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.*
- ◆ *Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.*

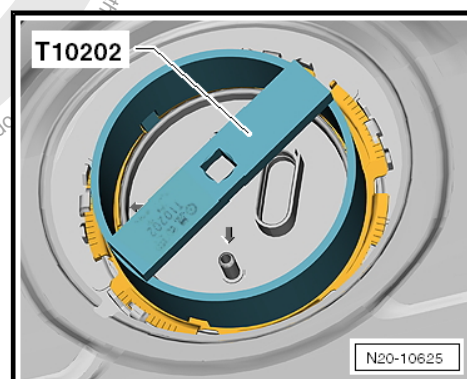
- Disconnect the 5-pin connector -1-, the black supply line -2- and the blue return line -3-.



# **Note**

*Press in securing ring to disengage the lines.*

- Open the locking ring using the Wrench - Fuel Sending Unit -T10202-

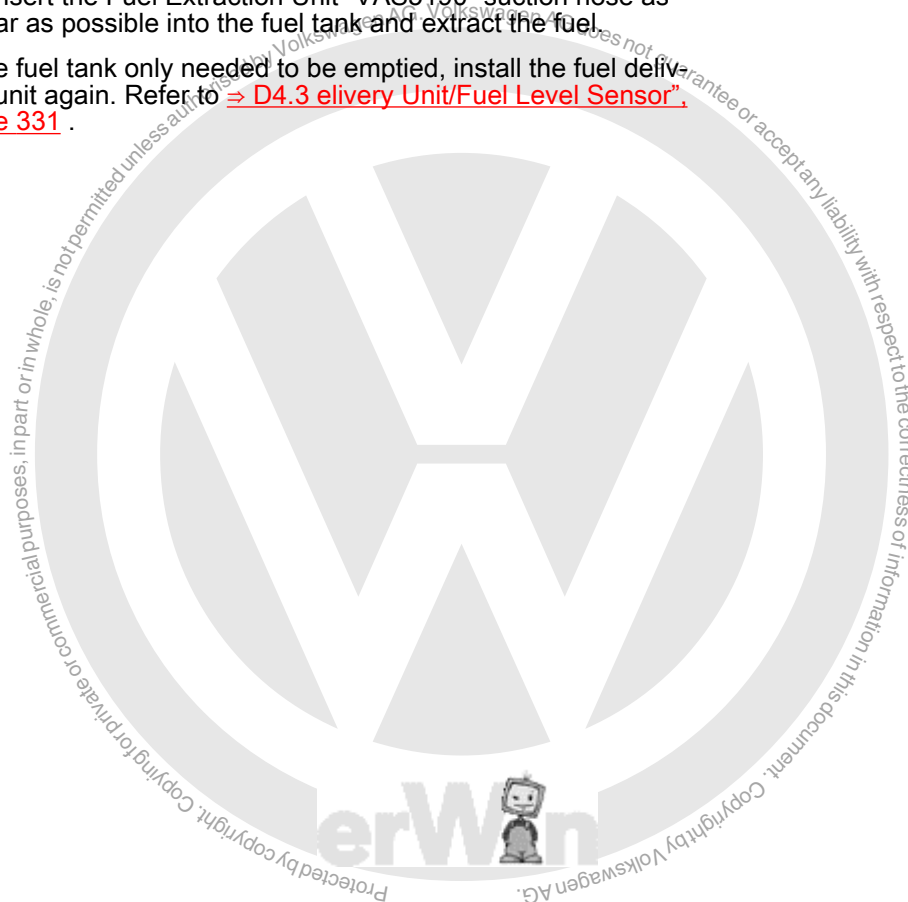






- Pull out fuel delivery unit slightly.
- Insert the Fuel Extraction Unit -VAS5190- suction hose as far as possible into the fuel tank and extract the fuel.

If the fuel tank only needed to be emptied, install the fuel delivery unit again. Refer to ➔ [D4.3 elivery Unit/Fuel Level Sensor](#), [page 331](#).





## 2 Description and Operation

⇒ [S2.1 ystem, Function Overview", page 281](#)

⇒ [-2.2 Accelerator Pedal Module", page 283](#)

⇒ [-2.3 EVAP System", page 283](#)

⇒ [-2.4 Fuel Filter", page 286](#)

⇒ [-2.5 Fuel Tank", page 287](#)

### 2.1 EVAP System, Function Overview





#### 1 - Separating Point

- ❑ In the front of the engine compartment on the right side, under the coolant expansion tank

#### 2 - Breather Line

- ❑ White
- ❑ From Evaporative Emission (EVAP) canister to the EVAP Canister Purge Regulator Valve 1 -N80-
- ❑ Installed position: on the right side the underbody
- ❑ Secured on the fuel tank.

#### 3 - Breather Line

- ❑ Green
- ❑ From the engine to the Leak Detection Pump -V144-
- ❑ Installed position: on the right side the underbody
- ❑ Secured on the fuel tank.

#### 4 - Separating Point

- ❑ In front of the fuel tank on the right side, near the fuel filter

#### 5 - Filler Neck

#### 6 - Breather Line

- ❑ From the filler neck to the EVAP canister

#### 7 - Air Filter

- ❑ For the Leak Detection Pump -V144-

#### 8 - Leak Detection Pump -V144-

- ❑ Component location: under the wheel housing liner inside right rear wheel housing
- ❑ Removing and installing. Refer to [⇒ D4.7 "Leak Detection Pump", page 342](#).
- ❑ Fuel system, checking for leaks. Refer to [⇒ S3.2 "Fuel System, Checking for Leaks", page 295](#)

#### 9 - Connecting Line

- ❑ From the Leak Detection Pump -V144- to the EVAP canister.
- ❑ Clip onto the bracket.

#### 10 - EVAP Canister

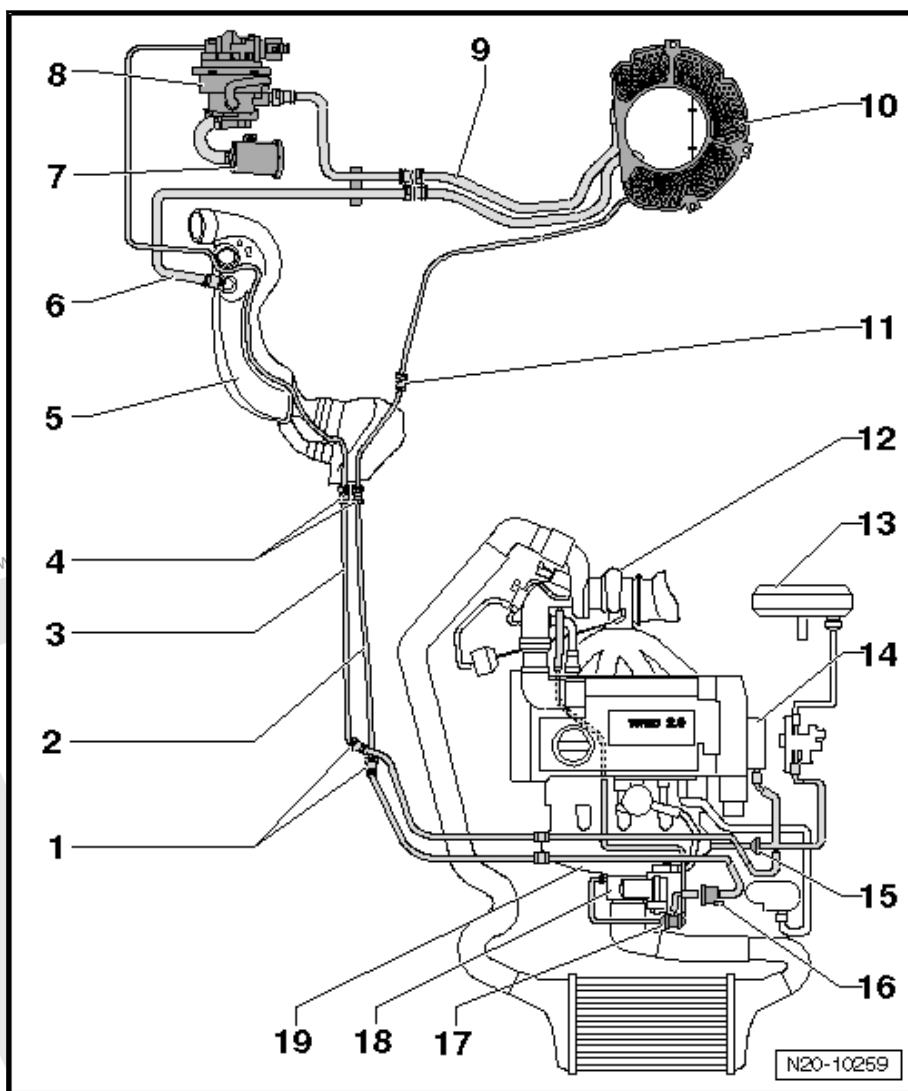
- ❑ Installed location: in the bottom of the spare tire well
- ❑ Removing and installing. Refer to [⇒ C4.2 "Canister", page 330](#).

#### 11 - Separating Point

- ❑ On the back right of the fuel tank

#### 12 - Turbocharger

#### 13 - Brake Booster



## 14 - Vacuum Pump

## 15 - Check Valve

- ☐ Installed position: the arrow points in the flow direction.

## 16 - EVAP Canister Purge Regulator Valve 1 -N80-

- ☐ Check Vehicle Diagnostic Tester

## 17 - Double Check Valve

- ☐ Checking. Refer to ➤ [C3.1 heck-Valve, Checking", page 294](#) .

## 18 - Throttle Valve Control Module -J338-

- ☐ Removing and installing. Refer to ➤ [T4.10 hrottle Valve Control Module J338", page 430](#) .

## 19 - Intake Manifold

## 2.2 Overview - Accelerator Pedal Module

### 1 - Connector

- ☐ Black 6-pin

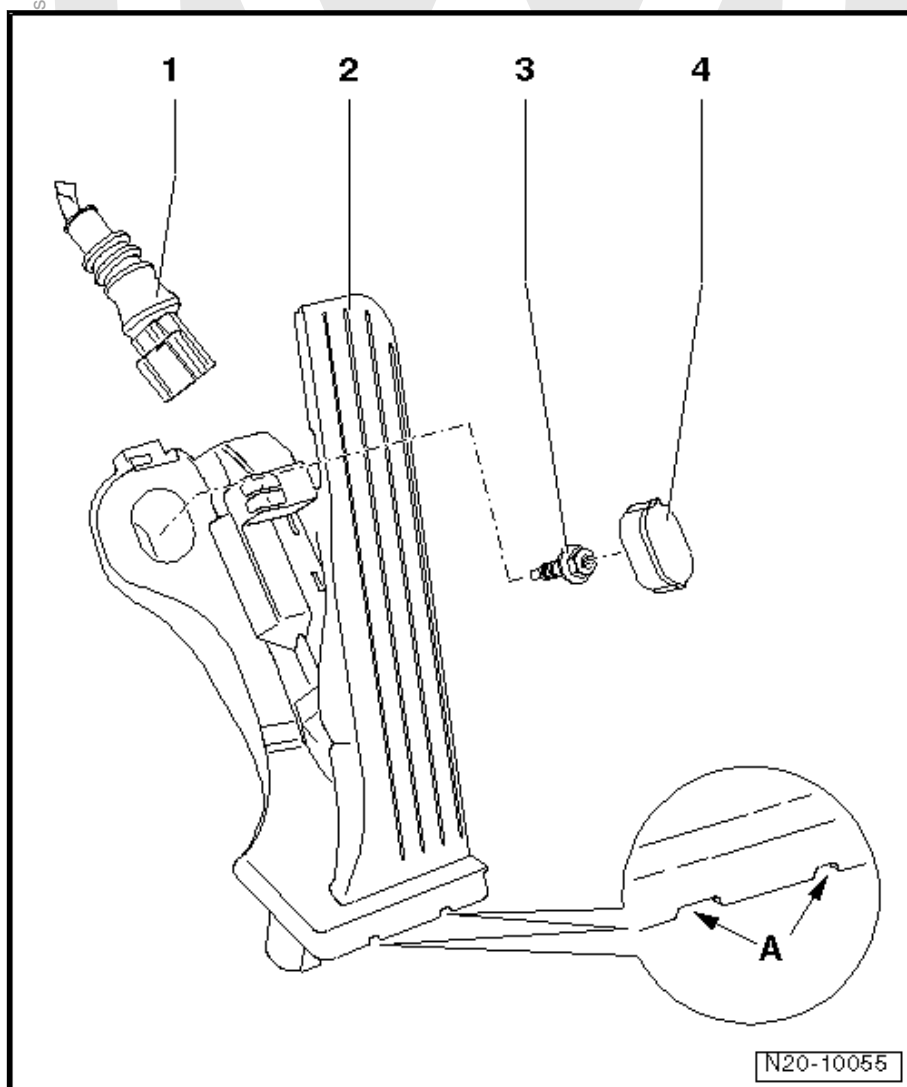
### 2 - Accelerator Pedal Position Sensor -G79- and Accelerator Pedal Position Sensor 2 -G185-

- ☐ Both sensors are integrated into one housing
- ☐ Not adjustable
- ☐ The Accelerator Pedal Position Sensor transmits the actuation by the driver to the Engine Control Module.
- ☐ -A- Openings for Release Tool
- ☐ Removing and installing. Refer to ➤ [P4.1 edal Module", page 328](#) .

### 3 - Bolt

- ☐ 10 Nm

### 4 - Cap



## 2.3 Overview - EVAP System

➤ [-2.3.1 EVAP System", page 283](#)

### 2.3.1 Overview - EVAP System



#### 1 - Nut

- ❑ 6 Nm

#### 2 - Leak Detection Pump - V144-

- ❑ Component location: under the wheel housing liner inside right rear wheel housing
- ❑ Evaporative Emission (EVAP) system, function overview. Refer to [⇒ S2.1 system, Function Overview](#), page 281
- ❑ Check the Leak Detection Pump -V144- vacuum supply. Refer to [⇒ D3.5 Leak Detection Pump, Checking Vacuum Supply](#), page 305 .
- ❑ Removing and installing. Refer to [⇒ D4.7 Leak Detection Pump](#), page 342 .
- ❑ Fuel system, checking for leaks. Refer to [⇒ S3.2 system, Checking for Leaks](#), page 295
- ❑ Fuel system leak test. Refer to [⇒ S3.3 system Leak Test](#), page 300

#### 3 - Connector

#### 4 - Vacuum Line

- ❑ To the vacuum pump
- ❑ Make sure it is secure

#### 5 - Filler Neck

- ❑ Engine Codes CAWB, CCZA

#### 6 - Breather Line

- ❑ Behind the wheel housing liner
- ❑ Make sure it is secure
- ❑ To disconnect, press release button on the connection piece.

#### 7 - Connecting Line

- ❑ Behind the wheel housing liner
- ❑ Make sure it is secure

#### 8 - Bolt

- ❑ 3 Nm

#### 9 - Air Filter

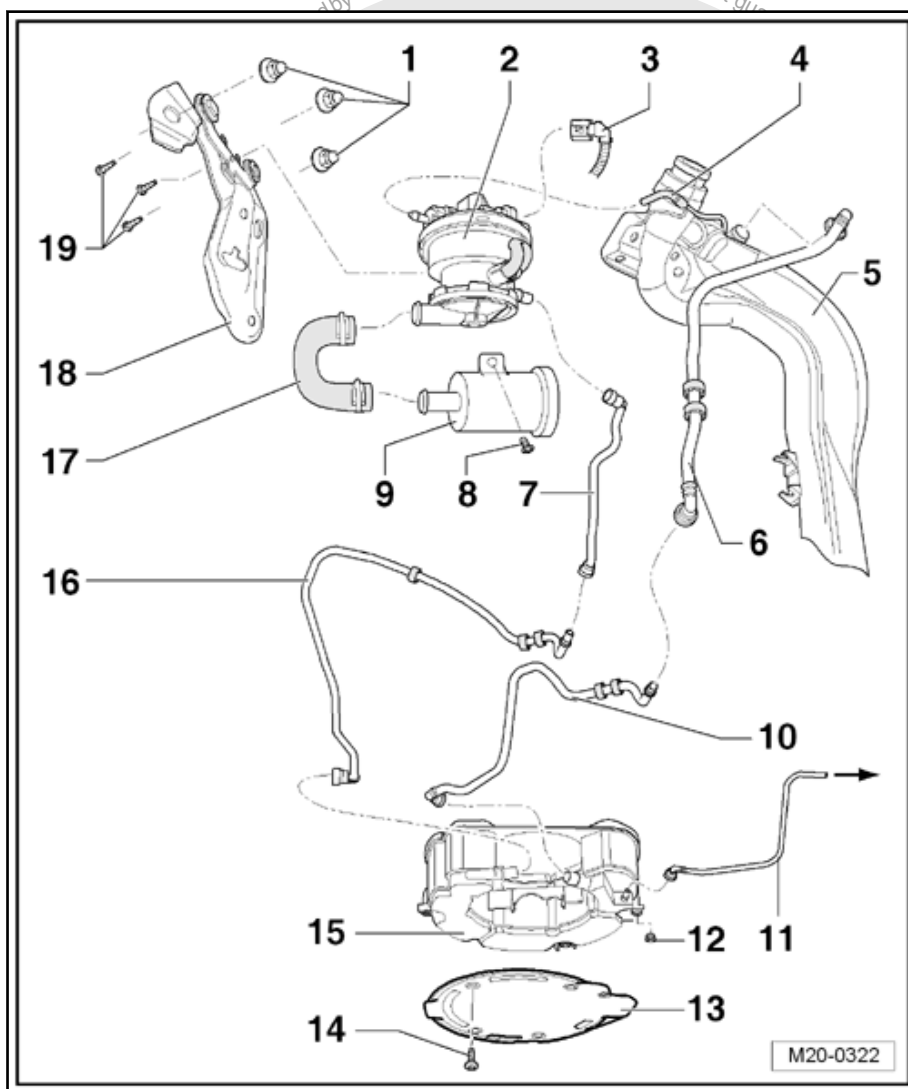
- ❑ For the Leak Detection Pump -V144-

#### 10 - Breather Line

- ❑ On the underbody
- ❑ Make sure it is secure
- ❑ Push in securing ring to pull off

#### 11 - Breather Line

- ❑ To the EVAP Canister Purge Regulator Valve 1 -N80-





- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off

## 12 - Spacer Sleeve

## 13 - Cover

- ☐ For the EVAP canister

## 14 - Bolt

- ☐ 8 Nm

## 15 - EVAP Canister

- ☐ Installed location: in the bottom of the spare tire well
- ☐ EVAP system, function overview. Refer to [⇒ S2.1 ystem, Function Overview", page 281](#)
- ☐ Removing and installing. Refer to [⇒ C4.2 anister", page 330](#) .

## 16 - Connecting Line

- ☐ On the underbody
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off

## 17 - Connecting Hose

- ☐ Make sure it is secure

## 18 - Bracket

- ☐ For the Leak Detection Pump -V144-

## 19 - Bolt

- ☐ 2 Nm

## 2.3.2 Overview - EVAP System, Engine Code CAWB, CCZA



#### 1 - EVAP Canister

- ☐ Component location:  
in the engine compartment  
on the right side
- ☐ If the tab has been re-  
leased, then the EVAP  
canister can be pulled  
from the bracket
- ☐ Checking fuel tank ven-  
tilation. Refer to ➤  
[T3.4 ank, Checking  
Ventilation", page 303](#) .

#### 2 - Pressure Retaining Valve with Connecting Hose

3 - 8 Nm

#### 4 - Breather Line

- ☐ To disconnect, press  
release button on the  
connection piece.
- ☐ Make sure it is secure

#### 5 - From the fuel tank

6 - 8 Nm

7 - 5 Nm

#### 8 - Bracket

- ☐ For the EVAP canister

#### 9 - From the Turbocharger

#### 10 - To the Intake Manifold

#### 11 - Double Check Valve

- ☐ Attached to the intake  
manifold

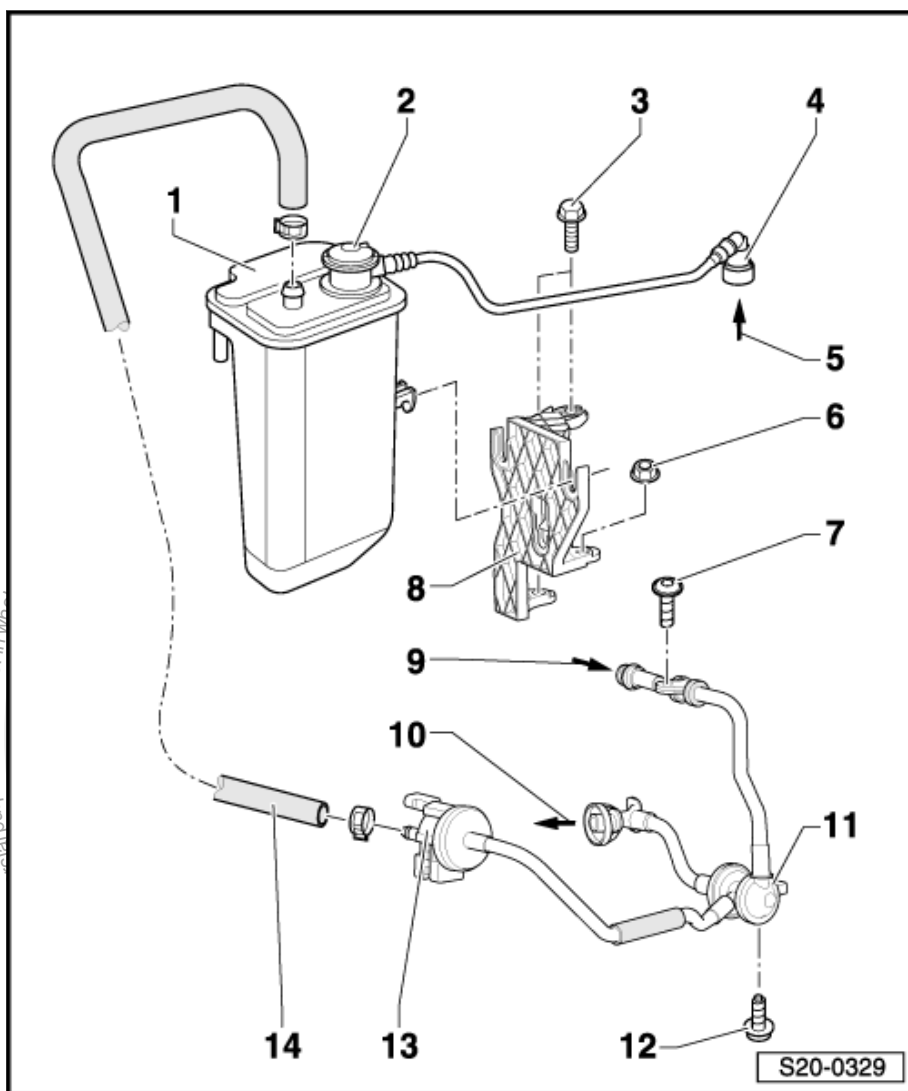
12 - 2 Nm

#### 13 - EVAP Canister Purge Regulator Valve 1 -N80-

- ☐ Overview - Installed location ➤ [-2.5 Intake Manifold", page 393](#) , Intake Manifold

#### 14 - Connecting Hose

- ☐ To the Intake Manifold
- ☐ Make sure it is secure



## 2.4 Overview - Fuel Filter



- ☐ With a pressure relief valve
- ☐ Direction of flow is marked with arrows
- ☐ Do not switch the connections.
- ☐ Removing and installing. Refer to ⇒ F4.4 „Inter“, page 335 .

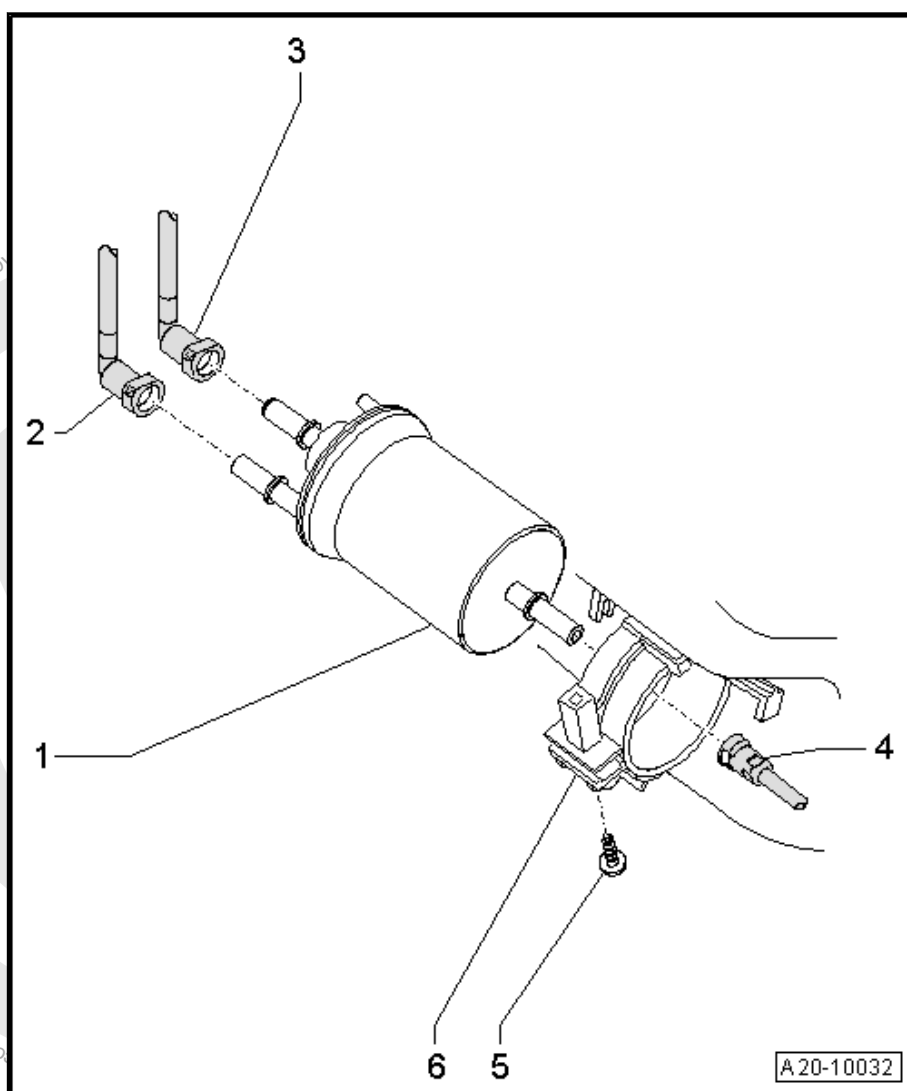
- ☐ Black
- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure
- ☐ To disconnect, press release button on the connection piece.
- ☐ From the fuel tank

- ☐ Blue
- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure
- ☐ To disconnect, press release button on the connection piece.
- ☐ To the fuel tank

- ☐ Black
- ☐ Make sure it is secure
- ☐ To disconnect, press release button on the connection piece.
- ☐ To the fuel rail

 3 Nm

☐ For fuel filter



⇒ -2.5.2 Fuel Tank", page 290

### 2.5.1 Overview - Fuel Tank, Engine Code CAWB, CCZA



**1 - Bolt**

**2 - Cap**

- ☐ Replace the seal if damaged.

**3 - Ground Connection**

- ☐ Make sure it is secure

**4 - Bolt**

- ☐ 11 Nm

**5 - Wiring Guide**

- ☐ For the ABS line

**6 - Bolt**

- ☐ 26 Nm
- ☐ Replacing
- ☐ Only use bolts with loose washers to secure the fuel tank mounting straps. If other bolts are used, the mounting straps could twist when the bolts are tightened. Bolts. Refer to the Parts Catalog.

**7 - Fuel Tank**

- ☐ Draining. Refer to ➤ [T1.1 ank. Draining", page 272](#) .
- ☐ Removing and installing. Refer to ➤ [T4.6 ank", page 338](#) .

**8 - Lock Washer**

**9 - Exhaust System Bracket**

- ☐ for exhaust system
- ☐ Replace if damaged

**10 - Mounting Strap**

- ☐ Note the installation position

**11 - Heat Shield**

**12 - Fuel Supply Line**

- ☐ Black
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off
- ☐ To the fuel rail

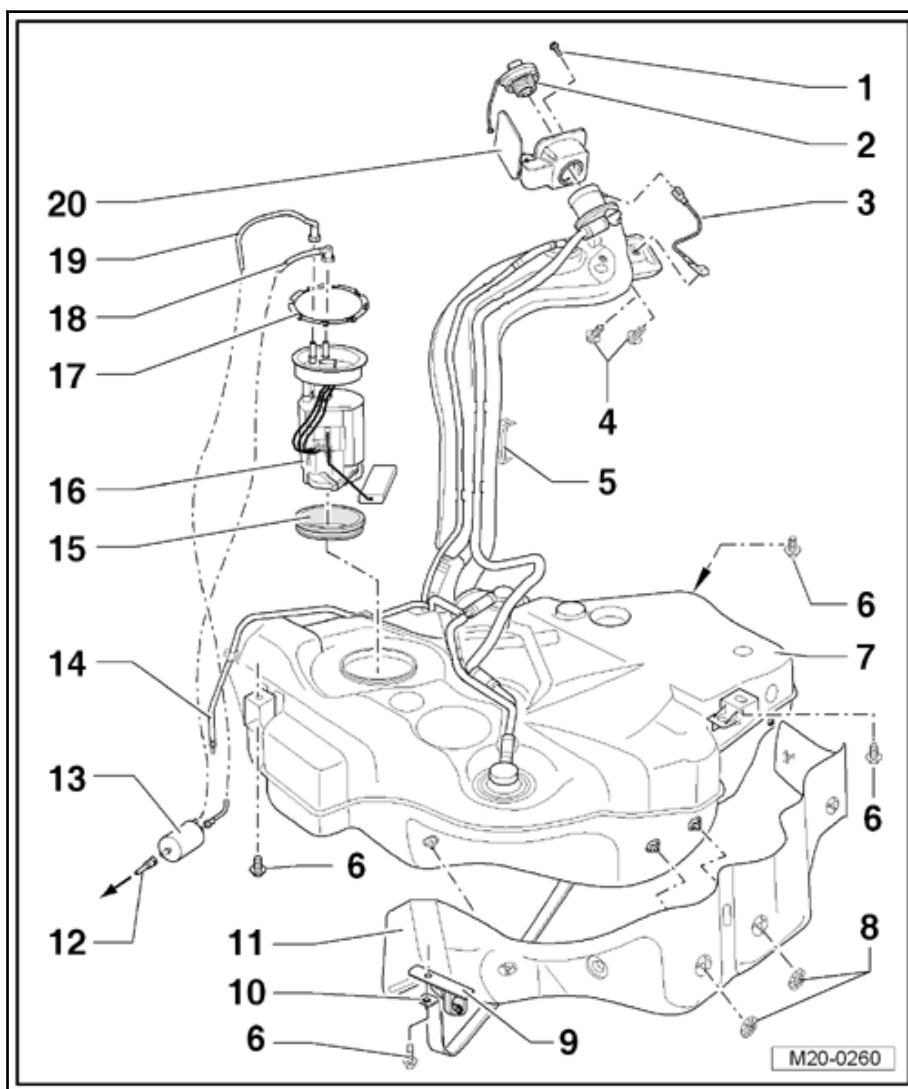
**13 - Fuel Filter**

- ☐ Direction of flow is marked with arrows
- ☐ Do not switch the connections.
- ☐ Overview - Fuel Filter with Attachments. Refer to ➤ [-2.4 Fuel Filter", page 286](#) .
- ☐ Removing and installing. Refer to ➤ [F4.4 ilter", page 335](#) .

**14 - Breather Line**

- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure

**15 - Gasket**



liability with respect to the correctness of information in this document.



- ☐ Replacing
- ☐ Insert dry into the fuel tank opening
- ☐ Coat the inside of seal with fuel only before installing the fuel delivery unit.

#### 16 - Fuel Delivery Unit

- ☐ Note installation position in fuel tank ⇒ [Fig. "Fuel delivery unit installed position", page 289](#)
- ☐ Removing and installing. Refer to ⇒ [D4.3 elivery Unit/Fuel Level Sensor", page 331](#) .
- ☐ Transfer Fuel Pump -G6-, Checking. Refer to ⇒ [T3.6 ransfer Fuel Pump G6, Checking", page 307](#) .
- ☐ With the Fuel Level Sensor -G-
- ☐ Fuel Level Sensor -G-, Removing and installing. Refer to ⇒ [F4.5 uel Level Sensor G ", page 337](#) .
- ☐ Clean the screen if it is dirty.

#### 17 - Locking Ring

- ☐ Make sure it is secure
- ☐ Remove and install with the Wrench - Fuel Sending Unit -T10202-
- ☐ 110 Nm

#### 18 - Fuel Supply Line

- ☐ Black
- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off

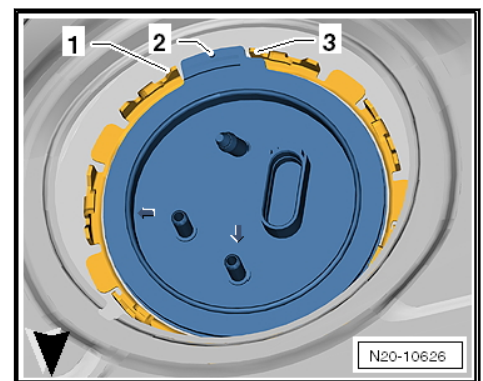
#### 19 - Fuel return line

- ☐ Blue
- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off

#### 20 - Fuel Filler Door Unit

- ☐ With rubber gasket
- ☐ Removing and installing. Refer to ⇒ Body Exterior; Rep. Gr. 55; Fuel Filler Door Unit; Fuel Filler Door Unit, Removing and Installing.

#### Fuel delivery unit installed position



The tab -2- on the fuel delivery unit must lie between the tabs -1- and -3-.



#### Note

- ◆ The -arrow- points in the direction of travel.
- ◆ The fuel delivery unit can only be installed in this position.



## 2.5.2 Overview - Fuel Tank





- 1 - Bolt
- 2 - Ground (GND) Connection

- ☐ Make sure it is secure

- 3 - Vacuum Line

- ☐ To the Leak Detection Pump -V144-

- 4 - Bolt

- ☐ 11 Nm

- 5 - Rivet

- 6 - Protective Plate

- ☐ Riveted to lower clamp at factory
- ☐ When replacing fuel tank, set protective plate on filler tube and rivet clamp (holes on protective plate must coincide with holes on filler tube).

- 7 - Wiring Guide

- ☐ For the ABS line
- ☐ Clipped to the shield

- 8 - Bolt

- ☐ 26 Nm
- ☐ Always replace
- ☐ Only use bolts with loose washers to secure the fuel tank mounting straps. If other bolts are used, the mounting straps could twist when the bolts are tightened. Bolts. Refer to the Parts Catalog.

- 9 - Fuel Tank

- ☐ Draining. Refer to [⇒ T1.1 ank, Draining", page 272](#).
- ☐ Removing and installing. Refer to [⇒ T4.6 ank", page 338](#).

- 10 - Lock Washer

- 11 - Exhaust System Bracket

- ☐ Replace if damaged
- ☐ For exhaust system

- 12 - Mounting Strap

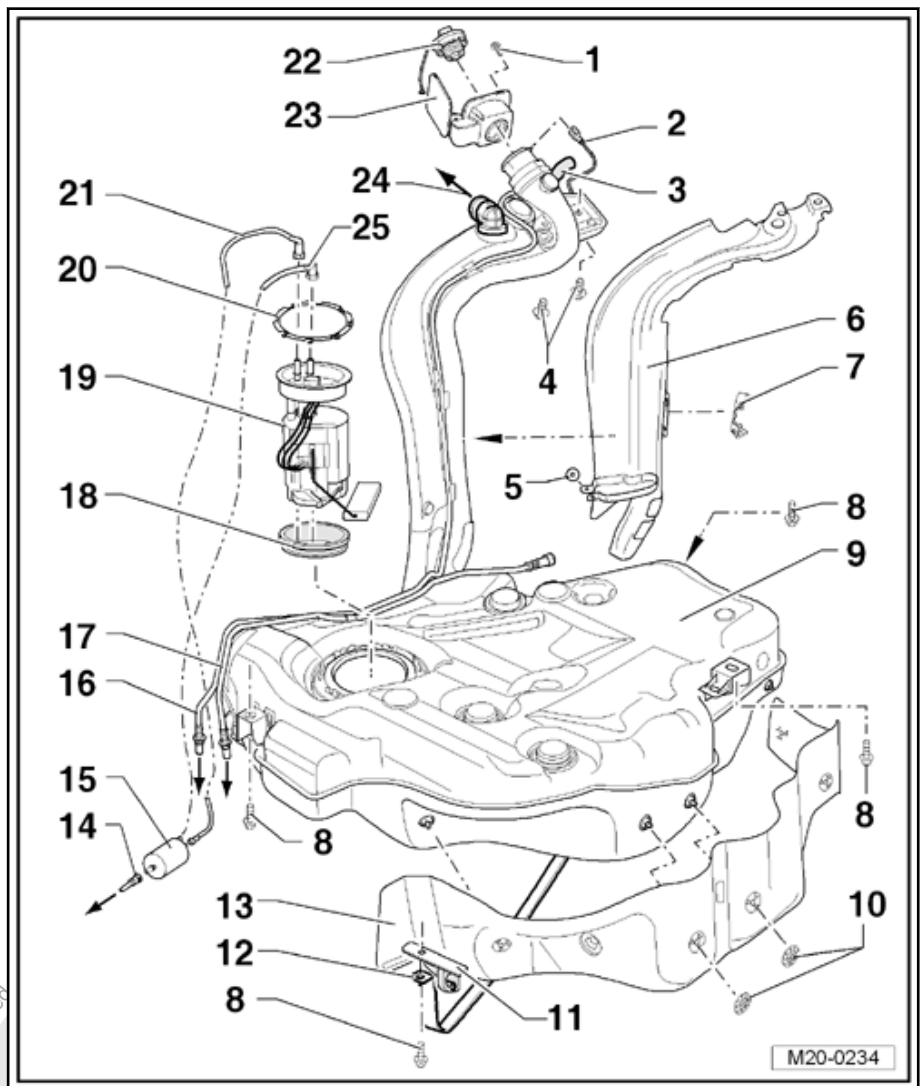
- ☐ Note the installation position

- 13 - Heat Shield

- 14 - Fuel Supply Line

- ☐ Black
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off
- ☐ To the fuel rail

- 15 - Fuel Filter





- ☐ Direction of flow is marked with arrows
- ☐ Do not switch the connections.
- ☐ Overview - fuel filter with attachments. Refer to [⇒ -2.4 Fuel Filter", page 286](#) .
- ☐ Removing and installing. Refer to [⇒ F4.4 ilter", page 335](#) .

#### 16 - Vacuum Line

- ☐ From the Leak Detection Pump -V144- to the intake manifold
- ☐ Clipped to the fuel tank
- ☐ Make sure it is secure

#### 17 - Breather Line

- ☐ From EVAP canister to the EVAP Canister Purge Regulator Valve 1 -N80-
- ☐ Clipped to the fuel tank
- ☐ Make sure it is secure

#### 18 - Gasket

- ☐ Always replace
- ☐ Insert dry into the fuel tank opening
- ☐ Coat the inside of seal with fuel only before installing the fuel delivery unit.

#### 19 - Fuel Delivery Unit

- ☐ Note installation position in fuel tank. Refer to [⇒ Fig. ""Fuel Delivery Unit Installed Position"" , page 293](#)
- ☐ Removing and installing. Refer to [⇒ D4.3 elivery Unit/Fuel Level Sensor", page 331](#) .
- ☐ Transfer Fuel Pump -G6-, checking. Refer to [⇒ T3.6 ransfer Fuel Pump G6, Checking", page 307](#) .
- ☐ With the Fuel Level Sensor -G-
- ☐ Fuel Level Sensor -G-, removing and installing. Refer to [⇒ F4.5 uel Level Sensor G", page 337](#) .
- ☐ Clean the screen if it is dirty.

#### 20 - Locking Ring

- ☐ 110 Nm
- ☐ Make sure it is secure
- ☐ Remove and install with the Wrench - Fuel Sending Unit -T10202-.

#### 21 - Fuel Return Line

- ☐ Blue
- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off

#### 22 - Cap

- ☐ Replace the seal if damaged.
- ☐ Engine code CCTA: with a threaded connection
- ☐ Engine code CBFA: with a bayonet connection

#### 23 - Fuel Filler Door Unit

- ☐ With rubber gasket
- ☐ Removing and installing. Refer to [⇒ Body Exterior; Rep. Gr. 55; Fuel Filler Door Unit; Fuel Filler Door Unit, Removing and Installing.](#)

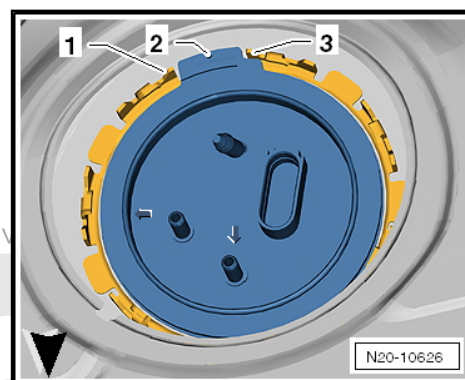
#### 24 - To the Evaporative Emission (EVAP) Canister

#### 25 - Fuel Supply Line

- ☐ Black
- ☐ Attached to the side of the fuel tank
- ☐ Make sure it is secure
- ☐ Push in securing ring to pull off



## Fuel Delivery Unit Installed Position



The tab -2- on the fuel delivery unit must lie between the tabs -1 and 3-.



### Note

- ◆ The -arrow- points in the direction of travel.
- ◆ The fuel delivery unit can only be installed in this position.





### 3 Diagnosis and Testing

⇒ [C3.1 heck-Valve, Checking", page 294](#)

⇒ [S3.2 ystem, Checking for Leaks", page 295](#)

⇒ [S3.3 ystem Leak Test", page 300](#)

⇒ [T3.4 ank, Checking Ventilation", page 303](#)

⇒ [D3.5 etection Pump, Checking Vacuum Supply", page 305](#)

⇒ [T3.6 ransfer Fuel Pump G6, Checking", page 307](#)

#### 3.1 Double Check-Valve, Checking

##### Special tools and workshop equipment required

- ◆ Hand Vacuum Pump -VAS6213-
- ◆ Connector Test Set -VAG1594C-

##### Test Conditions

- The EVAP Canister Purge Regulator Valve 1 -N80- was tested by the Vehicle Diagnostic Tester and is OK.

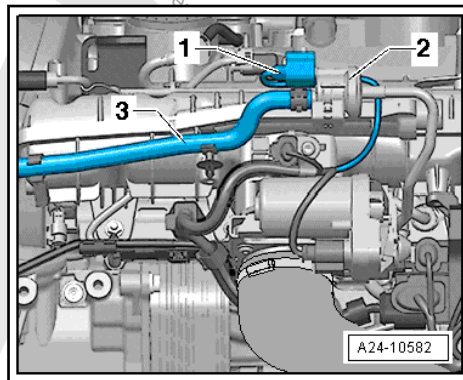
##### Test Sequence



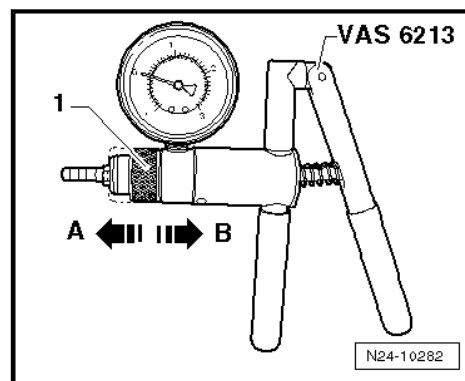
##### Note

Overview - intake manifold. Refer to [⇒ -2.5 Intake Manifold", page 393](#).

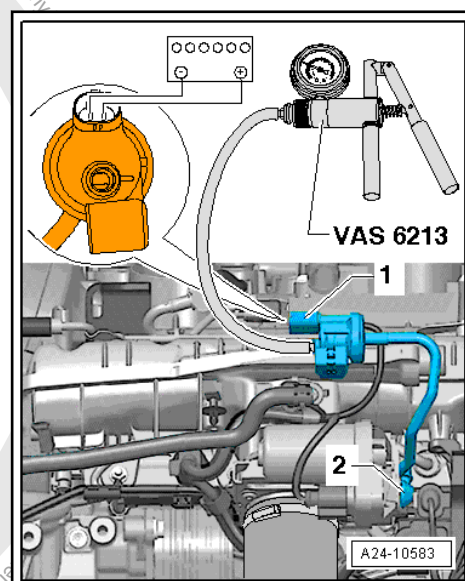
- Remove the engine cover. Refer to [⇒ C3.1 over", page 17](#).
- Remove the connector -1- and the bleed hose -3- from the EVAP Canister Purge Regulator Valve 1 -N80- -2-.



- Set the slide ring 1- on Hand Vacuum Pump -VAS6213- to position -A- for "vacuum".



- Connect the Hand Vacuum Pump -VAS6213- to the EVAP Canister Purge Regulator Valve 1 -N80-.



- Connect the EVAP Canister Purge Regulator Valve 1 -N80- contacts -1- to the Battery using adapter cables from the Connector Test Set -VAG1594C-. This opens the EVAP Canister Purge Regulator Valve 1 -N80-.
- Then run the Hand Vacuum Pump -VAS6213- several times.
  - A vacuum must form.
- Interrupt the voltage supply to the EVAP Canister Purge Regulator Valve 1 -N80-.

If no vacuum forms:

- Replace the double check valve -2- together with the EVAP Canister Purge Regulator Valve 1 -N80- -1-.

The double check valve, the EVAP Canister Purge Regulator Valve 1 -N80- and the plastic hoses are one component. The intake manifold must be removed to replace them.

## 3.2 Fuel System, Checking for Leaks

### Special tools and workshop equipment required

- ◆ Hose Clamps - Up To 2 mm -3094-
- ◆ Vehicle Diagnostic Tester
- ◆ Evaporative Emissions Tester -KLI9210-



- ♦ Evaporative Emissions Tester - Adapter 55 - Adapter Hose -KLI9210/55-1-

### Test Conditions

- “Guided Fault Finding” was performed using the Vehicle Diagnostic Tester.
- The Leak Detection Pump -V144- detected a leak.

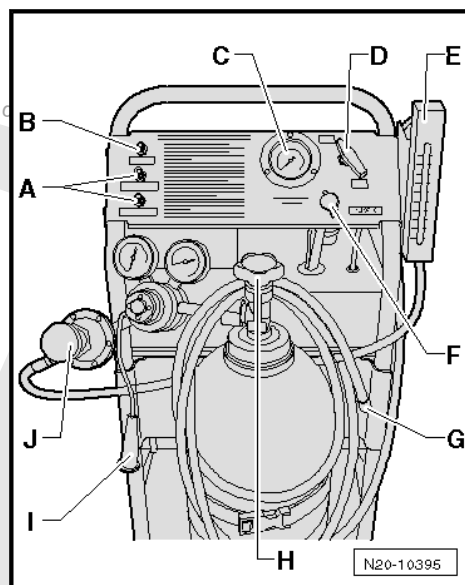
### Preparing the Evaporative Emissions Tester -KLI9210-:



#### Note

*Depending on the version, the appearance of the Evaporative Emissions Tester -KLI9210- may vary.*

- Check on the Evaporative Emissions Tester -KLI9210- whether there is enough fluid in the smoke generator.
- Set valve -D- to “Hold”.



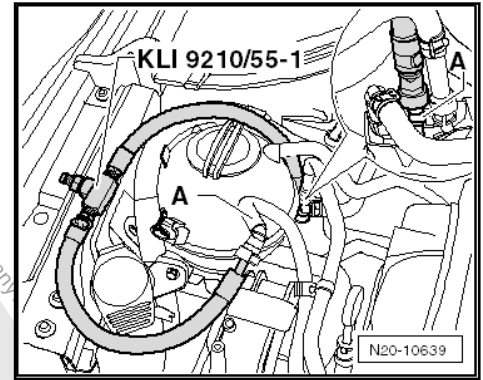
- Open the nitrogen bottle -H-.
- Connect the measuring hose -G- to the self-test connection -B-.
- Set valve -D- to “Test”.
- Using the pressure reducer -J-, adjust the pressure to 10 in. H<sub>2</sub>O (25 mbar) on.
- Set valve -D- to “Hold”.
- The pressure must now be maintained for a minimum of two minutes. If the pressure is not maintained, check the tester.

### Test Sequence

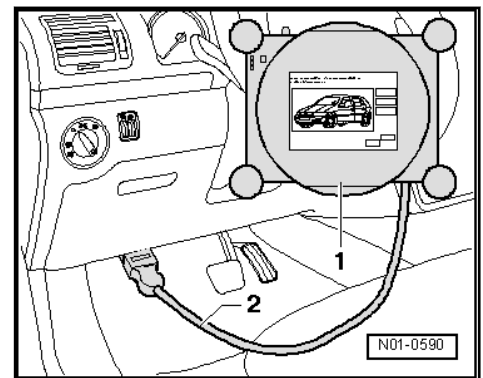
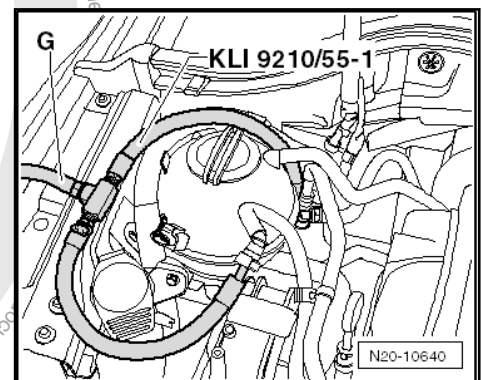
- Read the safety precautions before starting. Refer to [P1.2 recautions”, page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to [f1.1 or Clean Working Conditions”, page 1](#) .
- Connect the Evaporative Emissions Tester - Adapter 55 - Adapter Hose -KLI9210/55-1- to the breather lines -A- as illustrated.



- Connect the measuring hose -G- from the Evaporative Emissions Tester - KLI9210- to the Evaporative Emissions Tester - Adapter 55 - Adapter Hose -KLI9210/55-1-.



- Connect the Vehicle Diagnostic Tester - 1 - as follows:



- Connect diagnostic cable -2- to Data Link Connector (DLC) in driver footwell.
- Start the engine and let it run at idle speed.
- Select **Guided Functions** on the Vehicle Diagnostic Tester.
- Select **Check tank ventilation system for leaks** “guided function”.
- Start the test.
- Watch the pressure gauge on the Evaporative Emissions Tester -KLI9210- during the test.
- The Leak Detection Pump -V144- must pump the fuel system up to minimum 18 mbar (7 in. H<sub>2</sub>O).

The minimum pressure is not reached, but the pressure reached does not decrease:



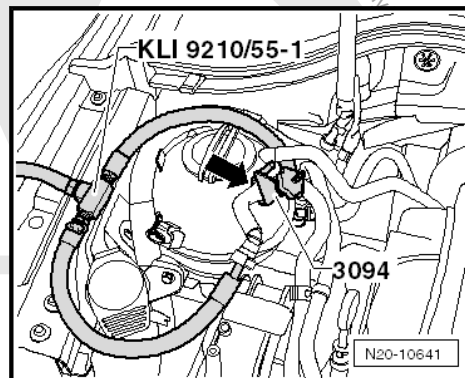
- Switch off the ignition.
- Perform a pressure retention test. Refer to ➤ [page 299](#) .

If no decrease in pressure is observed:

- Check the vacuum supply to the Leak Detection Pump - V144-. Refer to ➤ [D3.5 etection Pump, Checking Vacuum Supply](#)”, [page 305](#) .

The minimum pressure is not reached and the pressure reached decreases immediately:

- Clamp off the hose to the EVAP Canister Purge Regulator Valve 1 -N80- with a hose clamp -arrow-.



- Repeat the test.

If minimum pressure is not reached:

- Replace the EVAP Canister Purge Regulator Valve 1 -N80-.

If the minimum pressure is not reached again and the pressure that is reached decreases immediately:

- Leak in fuel system: perform “leak test in fuel system”. Refer to ➤ [S3.3 ystem Leak Test](#)”, [page 300](#) .

If minimum value is obtained:

- Switch off the ignition.

The valve in the Leak Detection Pump -V144- is now closed and the pressure is maintained.

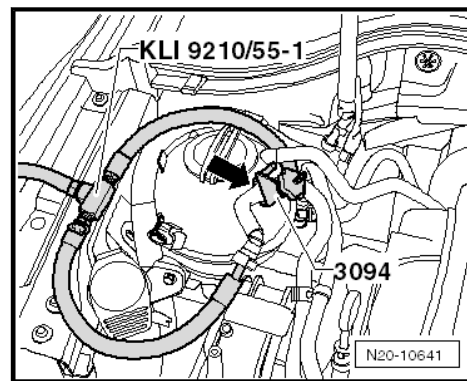
- Observe the pressure gauge:

If the pressure does not drop:

- Perform a pressure retention test to locate any possible leaks. Refer to ➤ [page 299](#) .

If the pressure drops:

- Clamp off the hose to the EVAP Canister Purge Regulator Valve 1 -N80- with a hose clamp -arrow-.



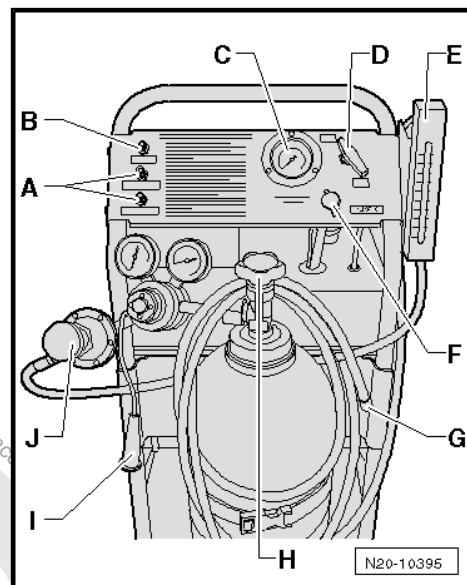
If pressure no longer drops now:

- Replace the EVAP Canister Purge Regulator Valve 1 -N80-.

If pressure still drops:

- Leak in fuel system: perform “leak test in fuel system”. Refer to [S3.3 ystem Leak Test](#), page 300 .

### Pressure Retention Test



- Set Valve -D- to “Test”. Increase the current pressure until it reaches 10 in. H<sub>2</sub>O (25 mbar).
- Pay attention to the pressure gauge -C- and the flow meter -E-. Let the flow rate decrease and if the pressure builds to 10 in. H<sub>2</sub>O (25 mbar), the fuel system is filled.



#### Note

*Depending on the level in the fuel tank, this procedure may take up to three minutes.*

- After the pressure has stabilized, set valve -D- to “Hold”.
- After five minutes, the pressure must not drop below 8 in. H<sub>2</sub>O (20 mbar).

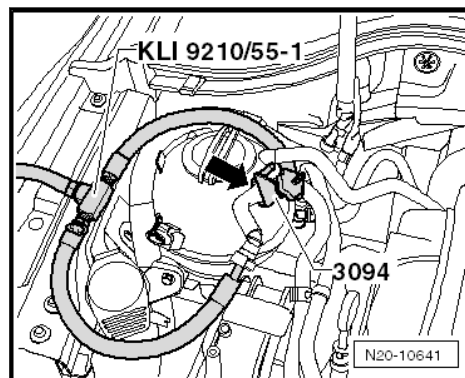
If the pressure is not maintained for 5 minutes, the leak should be localized as follows:

- First check the EVAP Canister Purge Regulator Valve 1 -N80- for leaks. To do this, clamp off the hose to the EVAP

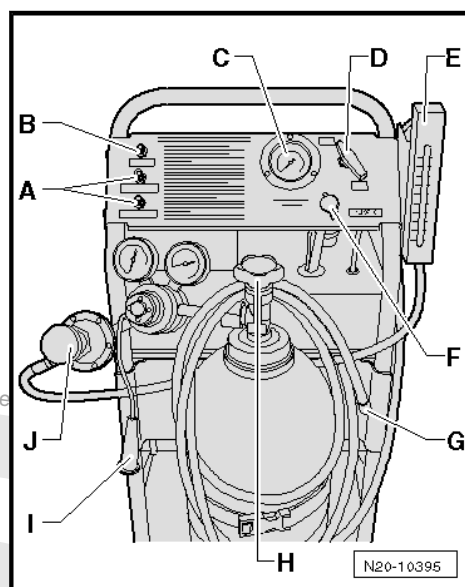




Canister Purge Regulator Valve 1 -N80- with a hose clamp  
-arrow-.



- Repeat pressure test by resetting the valve -D- to “Test”.



- Observe pressure gauge and flow meter:
    - The fuel system is filled if the flow rate decreases and the pressure increases to 10 in. H<sub>2</sub>O (25 mbar).
  - After the pressure has stabilized, set valve -D- to “Hold”.
- If pressure no longer drops now:
- Replace the EVAP Canister Purge Regulator Valve 1 -N80-.
- If pressure still drops:
- Perform the “fuel system leak test”. Refer to ⇒ [S3.3 ystem Leak Test](#), page 300 .
  - After completing the work, use the Vehicle Diagnostic Tester to run the Guided Function: Check tank ventilation system for leaks.

### 3.3 Fuel System Leak Test

Special tools and workshop equipment required

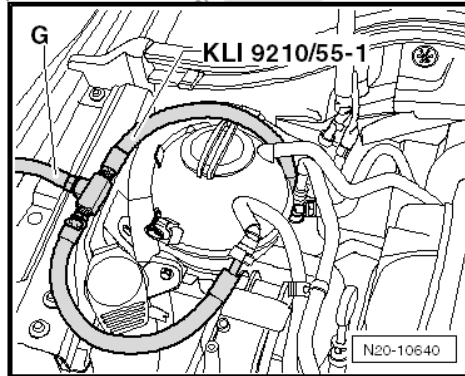
- ◆ Hose Clamps - Up To 25mm -3094-
- ◆ Evaporative Emissions Tester -KLI9210-



- ◆ Evaporative Emissions Tester - Adapter 55 - Adapter Hose - KLI9210/55-1-

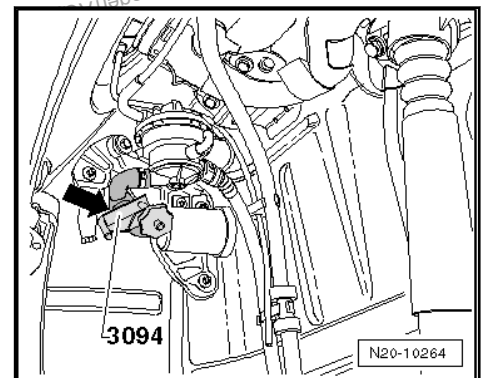
### Test Conditions

- The test "Fuel System, Checking for Leaks" is performed. Refer to ⇒ [S3.2 ystem, Checking for Leaks", page 295](#).
- The Evaporative Emissions Tester -KLI9210- must be connected to the vent line with the Evaporative Emissions Tester - Adapter 55 - Adapter Hose -KLI9210/55-1-.

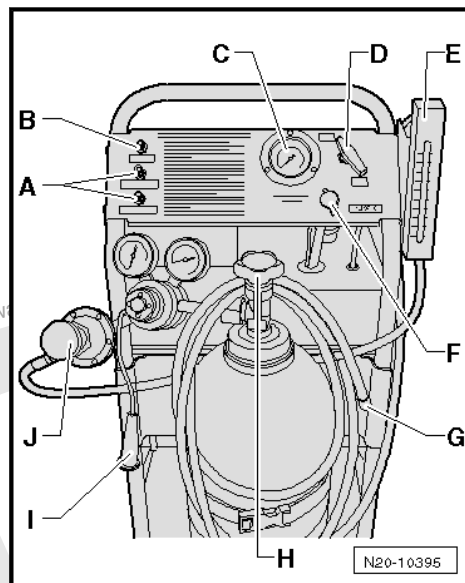


### Test Sequence

- Connect the Evaporative Emissions Tester -KLI9210- to the vehicle battery.
- Remove the right rear wheel.
- Remove the right rear wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Clamp off the connecting hose between the Leak Detection Pump - V144- and the air filter using Hose Clamps - Up To 25mm -3094- -arrow-.



- Set valve -D- to "Test".



- Pay attention to the pressure gauge -C- and the flow meter -E-. Let the flow rate decrease and if the pressure builds to 10 in. H<sub>2</sub>O (25 mbar), the fuel system is filled.



#### Note

*Depending on the level in the fuel tank, this procedure may take up to three minutes.*

- After the pressure has stabilized, set valve -D- to “Hold”.
- After five minutes, the pressure must not drop below 8 in. H<sub>2</sub>O (20 mbar).

If pressure no longer drops now:

- Replace the Leak Detection Pump -V144-. Refer to [D4.7 etection Pump](#), page 342 .

If the pressure is not maintained for a minimum of 5 minutes or if no pressure is built up, localize the leak as follows:

- Fill the fuel system with smoke by setting valve -D- to “Test”.
- While fuel system is being filled, press smoke generator button -I- for approximately one minute.

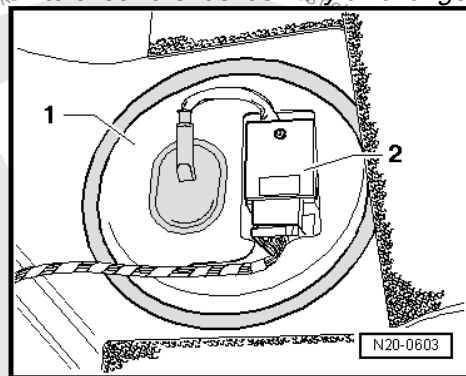
The fuel system is now under pressure and filled with smoke.

- Check all fuel system lines and hoses for escaping smoke. Also check the fuel filler cap.



#### Note

- ◆ *Illuminate components and hoses with a strong flood light, the smoke will be more visible.*
- ◆ *To check for leaks at accessible locations, also use ultrasonic measuring device or commercially available leak detection spray.*
- ◆ *Depending on how long fault finding lasts, the smoke generator button may need to be pressed again. This ensures there is enough smoke present in the fuel system.*
- ◆ *Remove the cover -1- to check the fuel delivery unit flange.*



- Replace the leaking hoses or components.
- After completing the work, use the Vehicle Diagnostic Tester to run the Guided Function: Check tank ventilation system for leaks.

### 3.4 Fuel Tank, Checking Ventilation

#### Special tools and workshop equipment required

- ◆ Hand Vacuum Pump -VAS6213-
- ◆ Fuel Injection Gauge Kit - Adapter Set -VAG1318/17A-
- ◆ Fuel Injection Gauge Kit - Fuel Bleeder 20 Adapter 1 VAG1318/20-1



#### Note

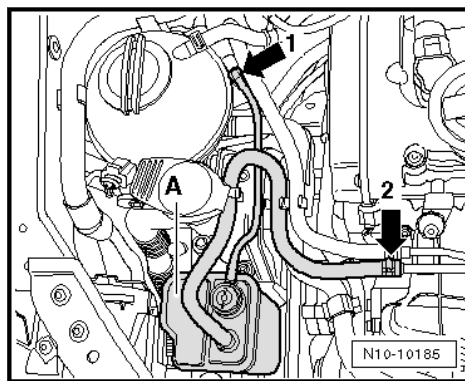
- ◆ *Hose connections are secured with either spring or hose clamps.*
- ◆ *Use Spring-Type Clip Pliers to installing spring clips.*
- ◆ *The fuel hoses on the engine may only be secured with spring clamps. Refer to the Parts Catalog.*

#### Test Conditions

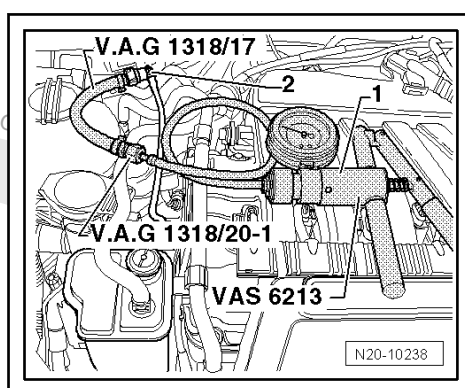
- The ignition must be off.

#### Test Sequence

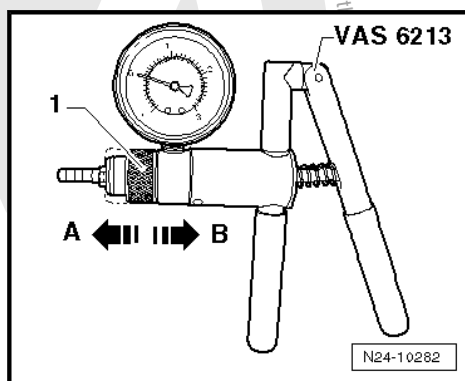
- Remove the bleed line -Arrow 1-. Press the locking ring.



- Connect the Hand Vacuum Pump -VAS6213- -1- to the ventilation line -2- for the Evaporative Emission (EVAP) canister as illustrated.



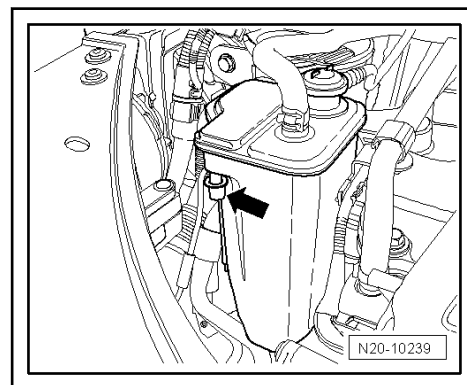
- Set the slide ring -1- of the Hand Vacuum Pump -VAS6213- to position -A- for “vacuum”.



- Operate the Hand Vacuum Pump -VAS6213- several times.
- No vacuum should be built up.

If a vacuum forms:

- Check the breather hole on the EVAP canister -arrow- for contamination and clean it if necessary.



If no vacuum forms:

- Seal the breather hole -arrow- and operate the vacuum pump several times again.
- A vacuum must form.

If no vacuum forms:

- Clamp off the connecting hose between the EVAP canister and EVAP Canister Purge Regulator Valve 1 -N80-.
- Operate the vacuum pump again a few times.

If no vacuum forms:

- Replace EVAP canister.

Vacuum:

- Replace the EVAP Canister Purge Regulator Valve 1 -N80-.

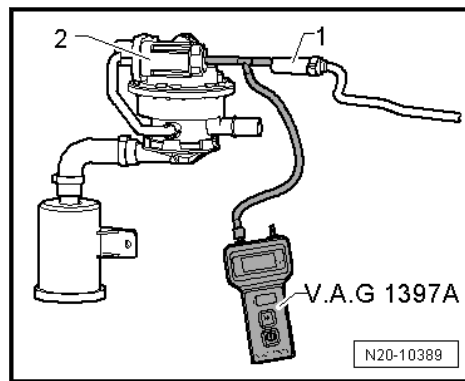
### 3.5 Leak Detection Pump, Checking Vacuum Supply


#### Special tools and workshop equipment required

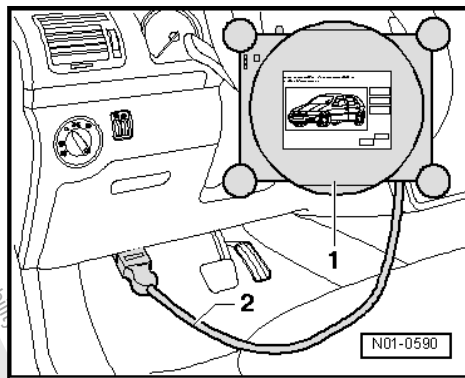
- ◆ Turbocharger Tester Kit - VAG1397A-
- ◆ Vehicle Diagnostic Tester
- ◆ T-Connection - 251 201 346-
- ◆ Hose 6 mm diameter

#### Test Sequence

- Read the safety precautions before starting. Refer to [⇒ P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to [⇒ f1.1 or Clean Working Conditions", page 1](#) .
- Remove the right rear wheel.
- Remove the right rear wheel housing liner. Refer to [⇒ Body Exterior; Rep. Gr. 66; Removal and Installation](#).
- Remove the vacuum line -1- from the Leak Detection Pump - V144-



- Connect the Turbocharger Tester Kit -VAG1397A- between the vacuum line -1- and the Leak Detection Pump -V144- -2- using the T-connection -251 201 346- and 6 mm hose .
- Switch on the measuring range  (absolute pressure measurement).
- Connect the Vehicle Diagnostic Tester -1- as follows:



Connect diagnostic cable -2- to Data Link Connector (DLC) in driver footwell.

- Start the engine and let it run at idle speed.
- Select **Guided Functions** on the Vehicle Diagnostic Tester.
- Select **Check tank ventilation system for leaks** "guided function".
- Start the test.
- During the test, pay attention to the display on the Turbocharger Tester Kit -VAG1397A-.
- The pressure must pulsate and must not rise above 0.700 bar (10.1 psi) (absolute pressure) during the test.

If the pressure rises above 0.700 bar (10.1 psi) during the test, the vacuum supply is too low.

- Check vacuum line to the vacuum pump for kinks or blockages.



### 3.6 Transfer Fuel Pump -G6-, Checking

⇒ [a3.6.1 nd Power Supply, Checking", page 307](#)

⇒ [P3.6.2 ressure, Checking", page 310](#)

⇒ [P3.6.4 ressure, Checking", page 315](#)

⇒ [Q3.6.5 uantity, Checking", page 318](#)

⇒ [D3.6.7 raw, Checking", page 326](#)

#### Special tools and workshop equipment required

- ◆ Pressure Tester Kit -VAS6550-
- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-
- ◆ Analog/Digital Multimeter -FLU83III-
- ◆ Wrench - Fuel Sending Unit -T10202-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Measuring container, three liter

#### 3.6.1 Function and Power Supply, Checking

- Battery voltage at least 11.5 V
- Fuel pump fuse on the fuse panel OK. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.
- Fuel Pump Control Module -J538- OK

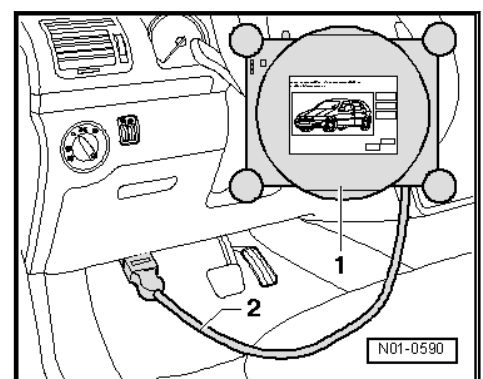
#### Test Sequence



#### Note

*The output diagnostic test mode checks the fuel pump.*

- Connect the Vehicle Diagnostic Tester as follows:



- Connect the diagnostic cable connector to the Data Link Connector (DLC) inside the driver footwell.
- Switch the ignition on.
- Press the buttons for Vehicle Self-Diagnosis, Engine Electronics and Output Diagnostic Test Mode (DTM) one after another on the display.
- Press right arrow button on display until output diagnostic test mode of fuel pump electronics.





Fuel pump must now accelerate slowly up to the maximum RPM.



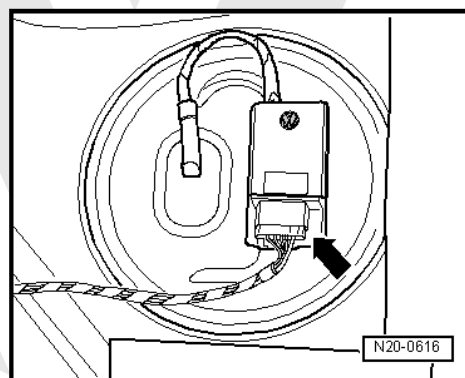
#### Note

*The fuel pump runs very quietly.*

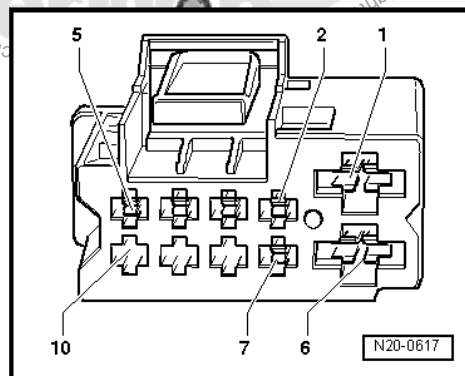
- Switch off the ignition.

#### If the Fuel Pump Does Not Start

- Remove the bench seat. Refer to ⇒ Body Interior; Rep. Gr. 72; Removal and Installation.
- Disconnect connector from Fuel Pump Control Module - J538-.



- Check the voltage supply between terminals -1 and 6- using an Analog/Digital Multimeter -FLU83III-.



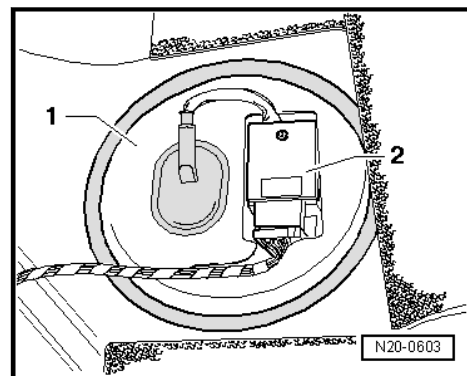
- Specified value: approximately battery voltage

#### Voltage Supply Not OK

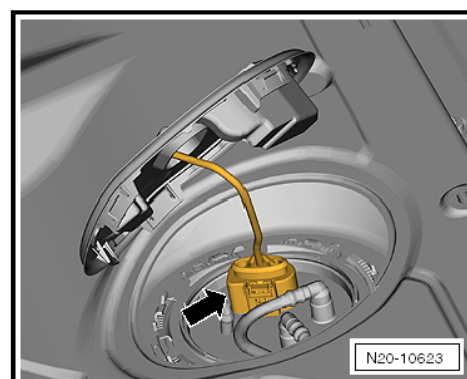
- Locate and repair the open circuit according to the wiring diagram. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.

#### Voltage Supply Is OK.

- Remove the cover -1- and Fuel Pump Control Module -J538-2- from the fuel delivery unit.



- Pull on the connector -arrow- without pressing the locking mechanism to make sure it is connected securely. If the connector was not connected correctly, check the fuel pump function again.



- Disconnect the connector.
- Check the contacts on the connector and the fuel delivery unit for damage.

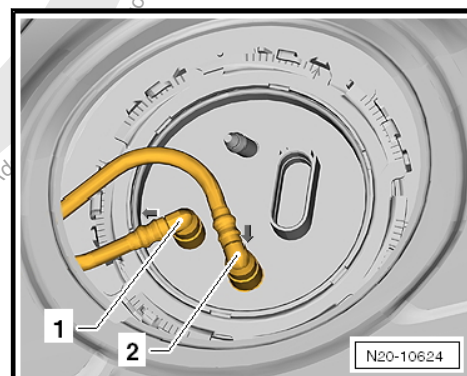


#### WARNING

***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

- Remove the fuel lines -1 and 2- from the flange.

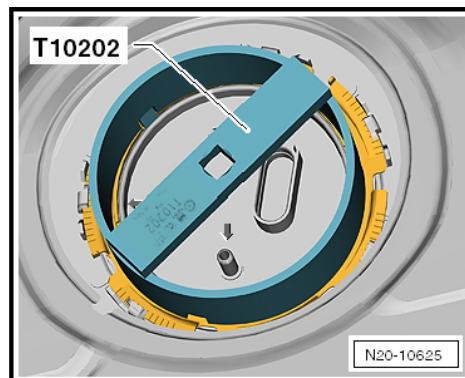




#### Note

*Press in securing ring to disengage the lines.*

- Open the locking ring using the Wrench - Fuel Sending Unit -T10202-.



- See if the wires between the flange and the fuel pump are connected.

#### If No Open Circuits Are Found

- Replace the fuel delivery unit if the fuel pump is faulty. Refer to [⇒ D4.3 elivery Unit/Fuel Level Sensor](#), page 331 .

### 3.6.2 Fuel Pressure, Checking

- Check the functionality of the fuel pump. Refer to [a3.6.1 nd Power Supply, Checking](#), page 307 .



#### Note

*Output diagnostic test mode activates the fuel pump.*

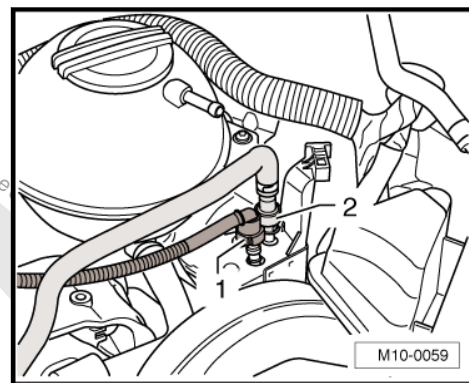


#### WARNING

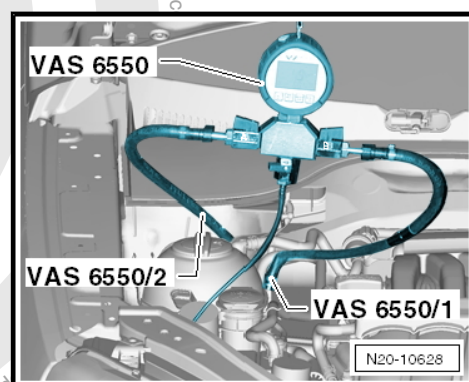
***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

- Remove the fuel supply line -2-. Push the locking ring upward and into the housing.



- Connect the Pressure Tester Kit -VAS6550- to the fuel supply line using the Pressure Tester Kit - Hose 1 -VAS6550/1- and Pressure Tester Kit - Hose 2 -VAS6550/2-.



- Make sure the drain is closed and the shut-off valves are open.
- Activate the fuel pump using output Diagnostic Test Mode (DTM) to build fuel pressure.
- Check the fuel pressure on the pressure gauge.
  - Target value: 4 to 7 bar (58 to 101.5 psi)

If fuel pressure is OK, check the residual pressure. Refer to ➤ [P3.6.4 Pressure, Checking", page 315](#).

#### **If the specified Value Is Exceeded**

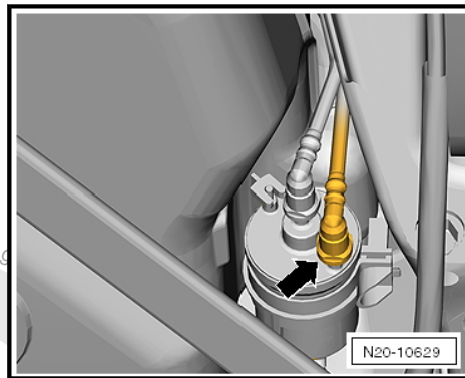
- Check the return line between the fuel filter and the fuel pump for kinks or blockages.

If no error can be found:

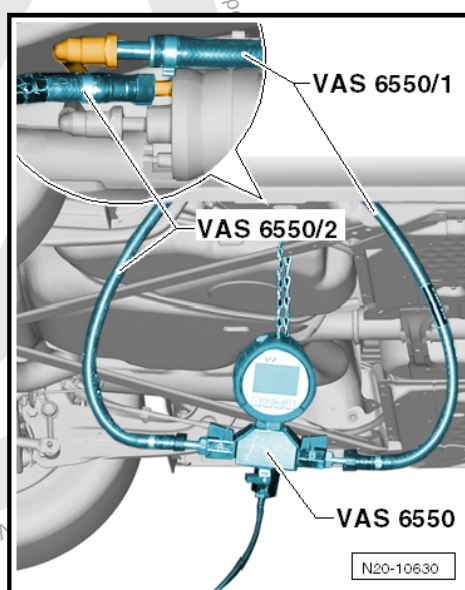
- Replace the fuel filter if the pressure relief valve inside the fuel filter is faulty.

#### **If the Specified Value Is Not Reached**

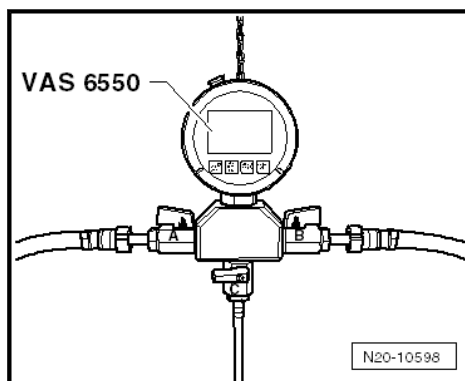
- Check the fuel pressure before the fuel filter as follows:
- Disconnect the fuel supply line -arrow- from the fuel filter.



- Connect the Pressure Tester Kit -VAS6550- and the Pressure Tester Kit - Hose 1 -VAS6550/1- and Pressure Tester Kit - Hose 2 -VAS6550/2- between the fuel filter and fuel supply line.



- Make sure the drain is closed and the shut-off valves are open.



- Turn on the ignition and activate the fuel pump using the output DTM.
- Close the shut-off valve -A- while the fuel pump is running.
- Pressure must increase to a minimum 7 bar (101.52 psi).
- If 7 bar (101.52 psi) is reached, immediately open the shut-off valve again.



If pressure has increased:

- Replace the fuel filter if the fuel pump is OK but the pressure relief valve in the fuel filter is faulty.

If pressure does not increase:

- Replace the fuel delivery unit if the fuel pump is faulty. Refer to ⇒ [D4.3 elivery Unit/Fuel Level Sensor](#), page 331 .

### 3.6.3 Fuel Pressure, Checking while Driving - Engine Code CCZA

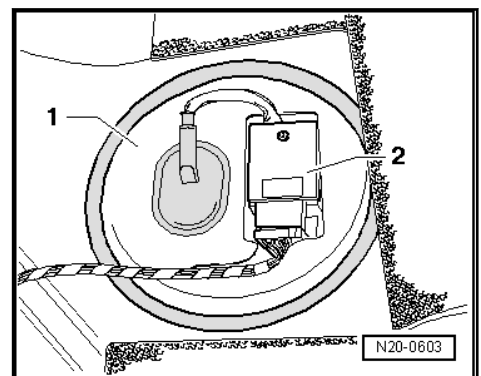


#### Note

- ◆ *If there are concerns about the driving behavior, the cause may be low fuel pressure. Malfunctions in the high pressure area can also be caused by low pressure.*
- ◆ *This test checks the high and low fuel pressure during a road test.*
- ◆ *The high fuel pressure is read from the engine control module. The low fuel pressure is measured through the Pressure Tester Kit -VAS6550- and transferred to the Vehicle Diagnostic Tester.*
- ◆ *This test can be a component of "Guided Fault Finding" if there is a DTC entry. It can also be started in the Vehicle Diagnostic Tester under "Function and Component Selection".*

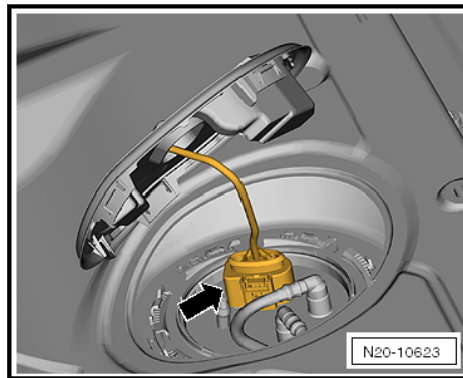
#### Special tools and workshop equipment required

- ◆ Pressure Tester Kit -VAS6550-
- ◆ Pressure Tester Kit - Hose 1 -VAS6550/1- and Pressure Tester Kit - Hose 2 -VAS6550/2-
- ◆ Vehicle Diagnostic Tester
- ◆ Vehicle Diagnosis System - Connection Lead -VAS5051/66-
- Remove the bench seat. Refer to ⇒ Body Interior; Rep. Gr. 72; Rear Seats; Rear Seat Backrest, Removing and Installing.
- Remove the cover -1- with the Fuel Pump Control Module -J538- -2- from the fuel delivery unit.



- Pull on the connector -arrow- without pressing the locking mechanism to make sure it is connected securely. If the connector was not connected correctly, it could cause a malfunction.



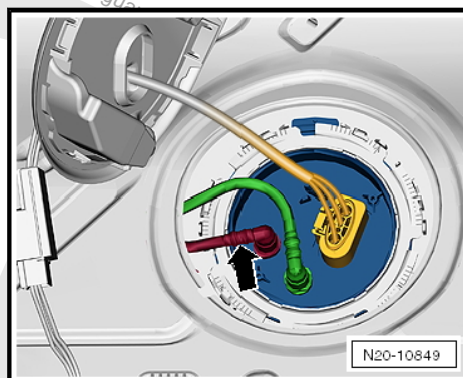


#### WARNING

***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

- Remove the supply line -arrow- and wipe up the draining fuel with a cleaning cloth.

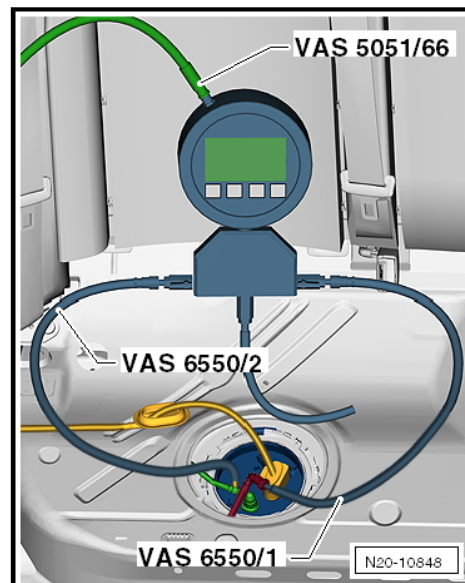


#### Note

***Press the locking ring to release the fuel line.***

- Connect the Pressure Tester Kit -VAS6550- to the fuel supply line using the Pressure Tester Kit - Hose 2 -VAS6550/2- and Pressure Tester Kit - Hose 1 -VAS6550/1-.





- Connect the Vehicle Diagnostic System - Connection Lead -VAS5051/66- to the Pressure Tester Kit -VAS6550- and to the Vehicle Diagnostic Tester.

Make sure the drain is closed and the shut-off valves are open.

- Switch on the Pressure Tester Kit -VAS6550-.

If the fuel pressure test is done within “Guided Fault Finding”, follow the instructions from the vehicle diagnostic tester.

If the fuel pressure test is done without “Guided Fault Finding”, proceed as follows:

Connect the Vehicle Diagnostic Tester to the vehicle.

- Select **Guided Fault Finding** in the Vehicle Diagnostic Tester.

- Perform the vehicle identification.

- Use the **GO TO** button to select the following menu items:

- ◆ **Function/component selection**

- ◆ **Drive**

- ◆ **Engine**

- ◆ **24-fuel injection system**

- ◆ **Mechanical components**

- ◆ **High pressure pump**

- Follow the instructions on the Vehicle Diagnostic Tester.

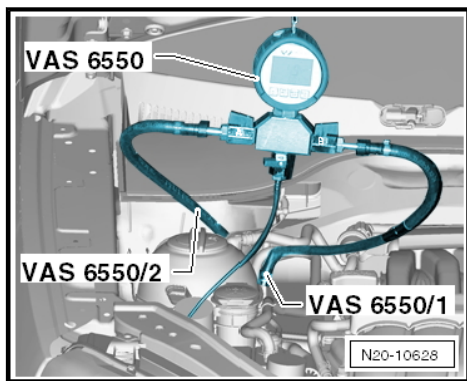


#### WARNING

*Testing and measuring instruments must be secured on the rear seat and operated by a second person from that location.*

### 3.6.4 Residual Pressure, Checking

- Fuel pressure OK and Pressure Tester Kit -VAS6550- connected. Check the fuel pressure. Refer to ➤ [P3.6.2 Pressure, Checking](#), page 310.

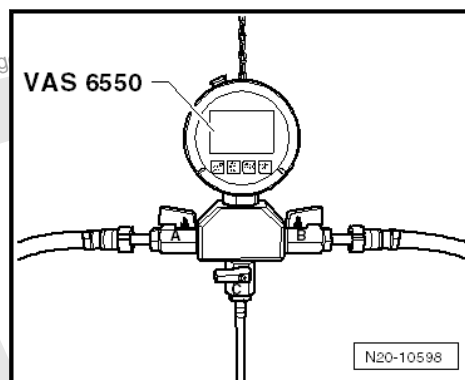


### Test Sequence

- Activate the fuel pump using output Diagnostic Test Mode (DTM) to build fuel pressure.
- Check the fuel pressure on the pressure gauge.
  - Target value: 4 to 7 bar (58 to 101.5 psi)
- End the On Board Diagnostics (OBD) and turn off the ignition.
- Watch the pressure decrease on the pressure gauge. The pressure must not drop below 3 bar (43 psi) after 10 minutes.

If the pressure drops further:

- Activate the fuel pump using output DTM to build fuel pressure.
- Close the shut-off valve -B- on the pressure gauge as soon as pressure accumulates. The lever is perpendicular to the flow direction.



### If Pressure No Longer Drops Now



#### Note

*Check for the leak on the engine side. Repeat the residual pressure check. Close the shut-off valve -A- this time to determine if there actually is a leak on the engine side.*

- Check fuel pipe to high pressure pump for leaks.

If no error can be found:

- Replace the high pressure pump. Refer to [P1,2 precautions](#), page 2.



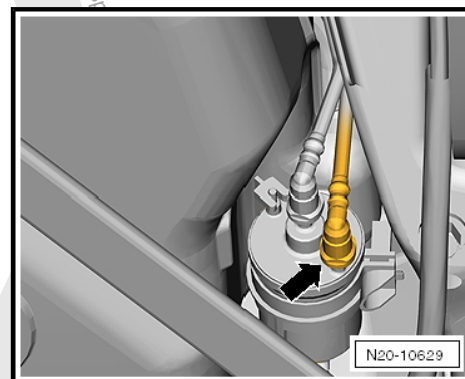
### If the Pressure Drops Again

Check for the leak on the fuel tank side. Proceed as follows:

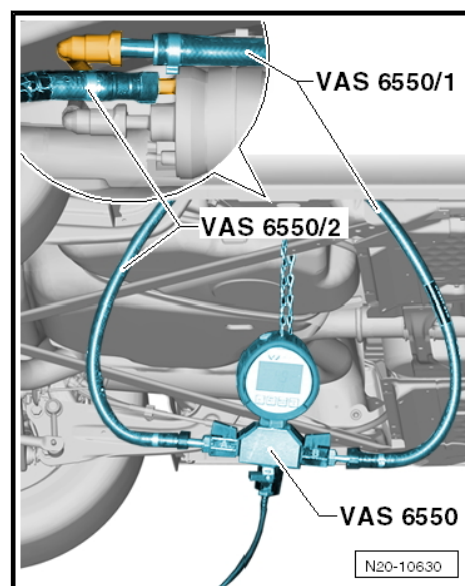
- Check the fuel line leading to the fuel filter for leaks.

If no faults are found on fuel line:

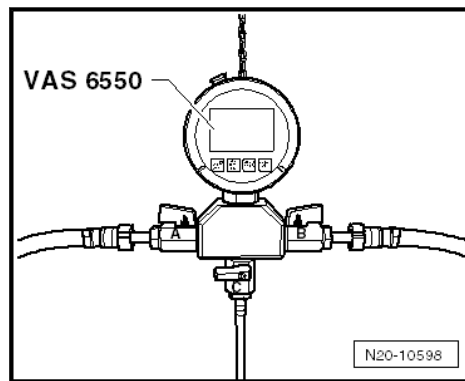
- Check the pressure retaining valve in the fuel delivery unit. Proceed as follows:
- Disconnect the fuel supply line -arrow- from the fuel filter.



- Connect the Pressure Tester Kit -VAS6550- and the Pressure Tester Kit - Hose 1 -VAS6550/1- and Pressure Tester Kit - Hose 2 -VAS6550/2- between the fuel filter and fuel supply line.



- Make sure the drain is closed and the shut-off valves are open.
- Activate the fuel pump using output diagnostic test mode to build fuel pressure.
- Check the fuel pressure on the pressure gauge.
  - Target value: 4 to 7 bar (58 to 101.5 psi)
- Close the shut-off valve -A- once the pressure has increased.



- Watch the pressure decrease on the pressure gauge. The pressure must not drop below 3 bar (43 psi) after 10 minutes.

If the pressure drops:

- Replace the fuel delivery unit if the pressure retention valve in the fuel pump is faulty. Refer to ➤ [D4.3 elivery Unit/Fuel Level Sensor](#), page 331.

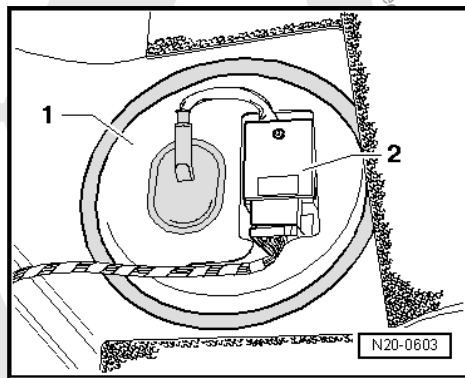
If the pressure does not drop:

- The pressure retention valve in the fuel pump is OK. The pressure relief valve in the fuel filter is faulty. Replace the fuel filter.

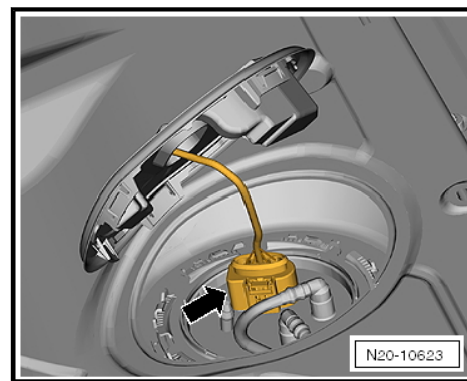
### 3.6.5 Delivery Quantity, Checking

#### Test Conditions

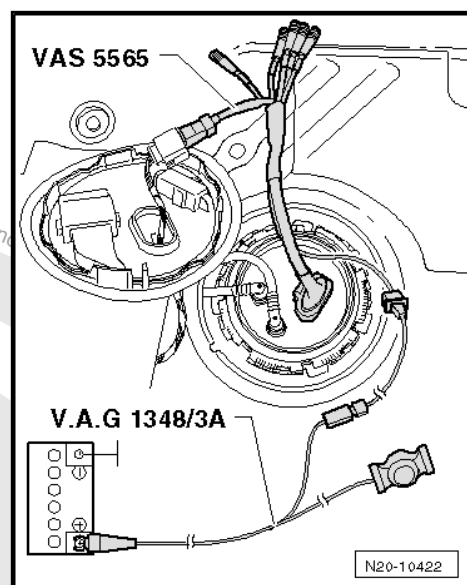
- Voltage supply OK.
- The fuel filter is OK.
- Remove the bench seat. Refer to ➤ Body Interior; Rep. Gr. 72; Removal and Installation.
- Remove the cover -1- and Fuel Pump Control Module -J538-2- from the fuel delivery unit.



- Pull on the connector -arrow- without pressing the locking mechanism to make sure it is connected securely. If the connector was not connected correctly, it could cause a malfunction.



- Disconnect the connector.
- Check the contacts on the connector and the fuel delivery unit for damage.
- Attach the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565- to the connector and to the fuel delivery unit.



- Connect the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A- to the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565- and the battery positive terminal clamp in the engine compartment.



#### Note

*This step allows the fuel pump to run when the engine is not running.*



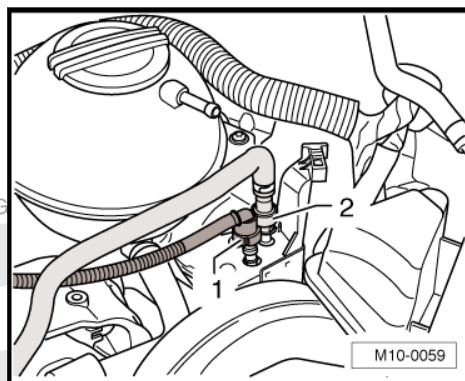
#### WARNING

**The fuel system is under pressure!**

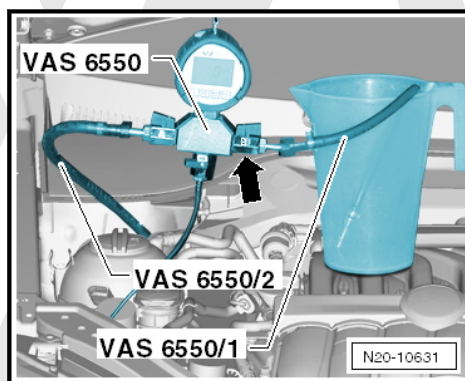
- ◆ **Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.**
- ◆ **Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.**



- Remove the fuel supply line -2-. Push the locking ring upward and into the housing.



- Connect the Pressure Tester Kit -VAS6550- with the Pressure Tester Kit - Hose 2 -VAS6550/2- to the fuel supply line. Hold the Pressure Tester Kit - Hose 1 -VAS6550/1- into a measuring container.



- Make sure the drain is closed and the shut-off valves are open.

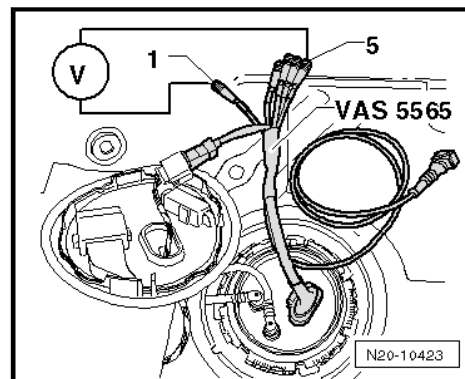


#### WARNING

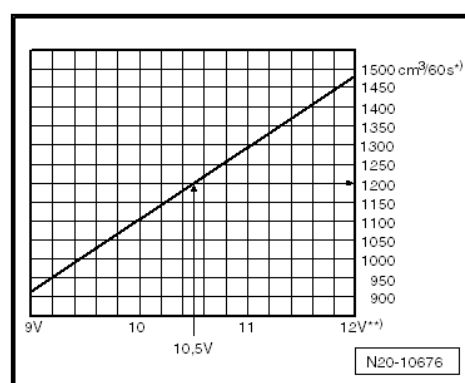
***Danger of spraying. Always wear protective eyewear and protective clothing to prevent injuries and contact with skin. Hold container in front of free connection of pressure measuring device.***

- Operate the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A-. While doing so, slowly close the shut-off valve -arrow- until the pressure gauge shows 4 bar (58 psi). From this point on do not move the position of the shut-off valve.
- Empty the measuring container.
- The fuel pump delivery rate is dependent on the battery voltage. Therefore, also connect the Analog/Digital Multimeter -FLU83III- to connectors -1 and 5- on the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-.





- Operate the remote control for 60 seconds and simultaneously measure the voltage on the fuel pump.
- Compare the quantity of fuel delivered with the specification.



\*) Minimum delivery rate  $\text{cm}^3/60 \text{ s}$

\*\*) Voltage on the fuel pump with engine running in idle and the pump is on.

### Example

During test, a voltage of 10.5 Volts is measured. This results in a minimum delivery quantity of approximately  $1200 \text{ cm}^3/60 \text{ s}$ .

### If the Specified Value Is Not Reached

- Check the fuel lines for possible restrictions (kinks) or blockages.

If no error can be found:

- Remove the cap from the fuel filler tube and repeat the test. If the fuel delivery rate is now reached, check the fuel tank breather.

### If the Specified Value Is Not Reached Again

- Check the fuel filter as follows:



### WARNING

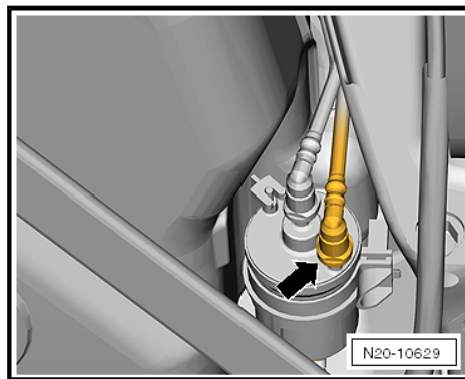
**The fuel system is under pressure!**

- ◆ Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.
- ◆ Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.

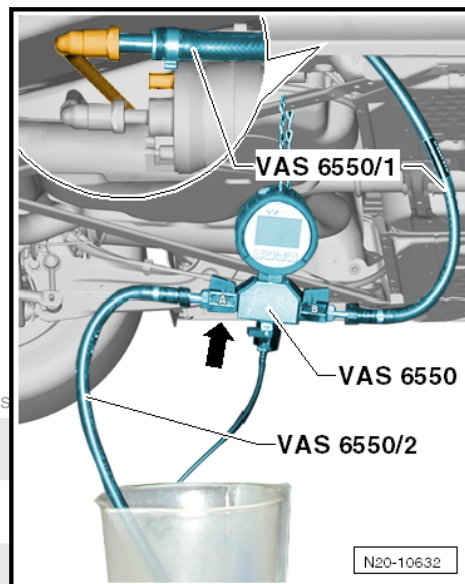




- Disconnect the fuel supply line -arrow- from the fuel filter.



- Connect the Diesel Pressure Tester Kit -VAS6550- with the Pressure Tester Kit - Hose 1 -VAS6550/1- to the fuel supply line. Hold the Pressure Tester Kit - Hose 2 -VAS6550/2- into a measuring container.



- Make sure the drain is closed and the shut-off valves are open.
- Operate the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A-. While doing so, slowly close the shut-off valve -arrow- until the pressure gauge shows 4 bar (58 psi). From this point on do not move the position of the shut-off valve.
- Empty the measuring container.
- Repeat the fuel delivery rate test.

If the minimum delivery rate is now reached:

- Replace the fuel filter.

If minimum delivery rate is again not obtained:

- Remove the fuel delivery unit and check the fuel screen for debris.

Only when up to now no malfunction has been detected:

- Replace the fuel delivery unit.



If the delivery rate has been obtained, but malfunctions are still suspected in the fuel supply (for example, intermittent loss of fuel supply):

- Check the fuel pump current draw. Refer to ➤ [D3.6.7 raw, Checking](#), page 326 .

### 3.6.6 Delivery Quantity, Checking - Engine Code CCZA



#### Note

*The fuel delivery rate is first checked inside the engine compartment with Guided Functions "check fuel delivery rate, quick test". Perform a second measurement on the fuel delivery unit flange if the minimum delivery rate is not attained.*

#### Checking the fuel delivery rate in the engine compartment:

- Connect the Vehicle Diagnostic Tester to the vehicle.
- Select **Guided Functions** in the Vehicle Diagnostic Tester.
- Perform the vehicle identification.
- Select **engine**.
- Select **check fuel delivery rate, quick test**.
- Follow the instructions on the Vehicle Diagnostic Tester.

#### Checking the fuel delivery rate on the flange:

- "Check fuel delivery rate, quick test" was performed using the ➤ Vehicle diagnostic tester.
- The Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A- and the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565- are connected to the fuel delivery unit.
- Battery charger is connected
- Fuel level inside the fuel tank is above reserve

#### Test sequence:

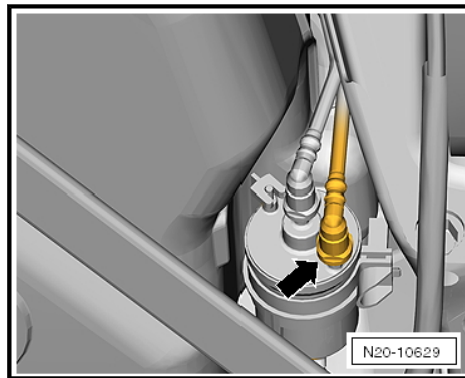


#### WARNING

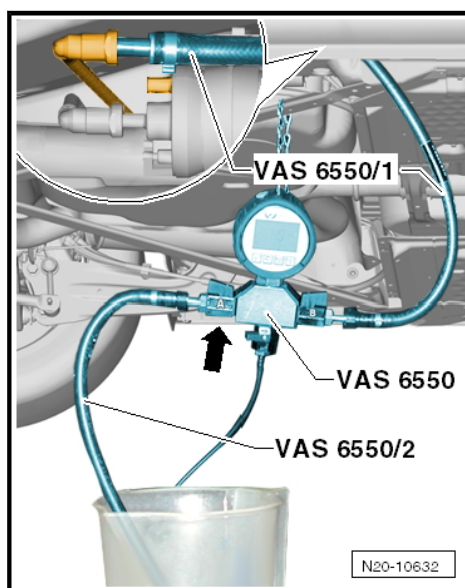
***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

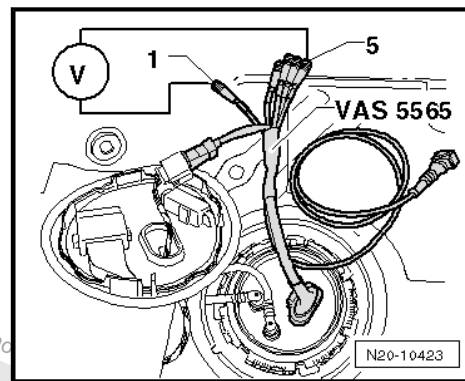
- Disconnect the fuel supply line -arrow- from the fuel filter.



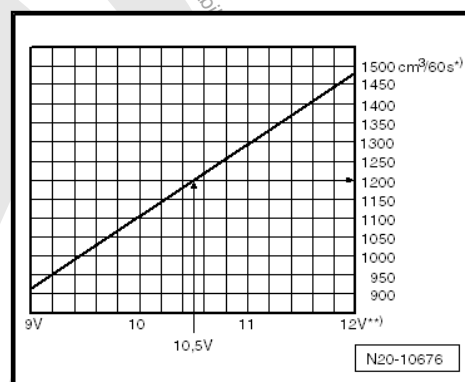
- Connect the Diesel Pressure Tester Kit -VAS6550- with the Pressure Tester Kit - Hose 1 -VAS6550/1- to the fuel supply line. Hold the Pressure Tester Kit - Hose 2 -VAS6550/2- into a measuring container.



- Make sure the drain is closed and the shut-off valves are open.
- Operate the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A-. While doing so, slowly close the shut-off valve -arrow- until the pressure gauge shows 4 bar. From this point on do not move the position of the shut-off valve.
- Empty the measuring container.
- The fuel pump delivery rate is dependent on the battery voltage. Due to this, also connect the Analog/Digital Multimeter -FLU83III- to wires -1- and -5- from the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-.



- Operate the remote control for 60 seconds and simultaneously measure the voltage on the fuel pump.
- Compare the quantity of fuel delivered with the specification.



\*) Minimum delivery rate  $\text{cm}^3/60 \text{ s}$

\*\*) Voltage on the fuel pump with engine running in idle and the pump is on.

Example:

During test, a voltage of 10.5 Volts is measured. This results in a minimum delivery rate of approximately  $1200 \text{ cm}^3/60 \text{ s}$ .

**If the specified value is not reached:**

- Remove the cap from the fuel filler tube and repeat the test. If the fuel delivery rate is now reached, check the fuel tank breather.

**If the specified value is not reached again:**

- Remove the fuel delivery unit and check the fuel screen for debris.
- If there is no malfunction here as well, replace the flange with the fuel filter.
- Repeat the test.

**If the specified value is not reached again:**

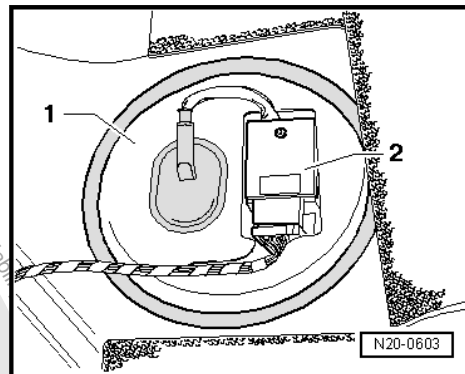
- Replace the fuel delivery unit if the fuel pump is faulty. Refer to [⇒ D4.3 elivery Unit/Fuel Level Sensor, page 331](#).

If the delivery rate has been obtained, but malfunctions are still suspected in the fuel supply (for example, intermittent loss of fuel supply): Checking the fuel pressure while driving. Refer to [⇒ P3.6.3 ressure, Checking while Driving - Engine Code CCZA, page 313](#)

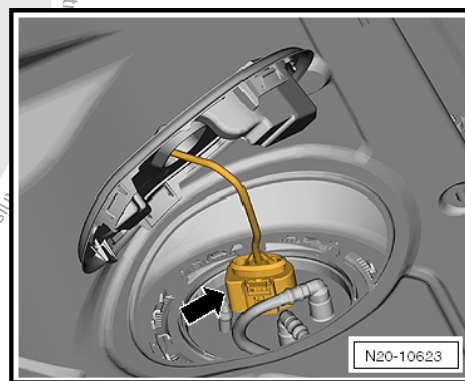


### 3.6.7 Current Draw, Checking

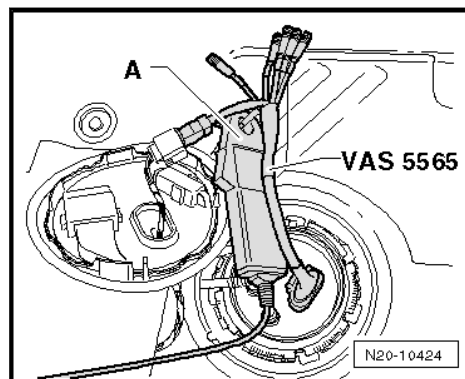
- Remove the bench seat. Refer to ➔ Body Interior; Rep. Gr. 72; Removal and Installation.
- Remove the cover -1- and Fuel Pump Control Module -J538-2- from the fuel delivery unit.



Pull on the connector -arrow- without pressing the locking mechanism to make sure it is connected securely. If the connector was not connected correctly, it could cause a malfunction.



- Disconnect the connector.
- Check the contacts on the connector and the fuel delivery unit for damage.
- Attach the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565- to the connector and to the fuel delivery unit.



- Connect the current probe -A- to the red wire with the word "current probe" on the Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-.
- Start the engine and run at idle speed.



- Measure the current draw of the fuel pump.
- Specified value: maximum 9 amps



#### Note

- ◆ *The fuel pump starting current may be higher than the specified value briefly when starting the engine.*
- ◆ *If the malfunction in the fuel system only occurs sporadically, the test can also be performed during a road test. A second person is required to do this.*

If the current draw is exceeded:

- Replace the fuel delivery unit if the fuel pump is faulty. Refer to [⇒ D4.3 elivery Unit/Fuel Level Sensor](#), page 331 .



## 4 Removal and Installation

⇒ [P4.1 edal Module", page 328](#)

⇒ [C4.2 anister", page 330](#)

⇒ [D4.3 elivery Unit/Fuel Level Sensor", page 331](#)

⇒ [F4.4 ilter", page 335](#)

⇒ [F4.5 uel Level Sensor G ", page 337](#)

⇒ [T4.6 ank", page 338](#)

⇒ [D4.7 etection Pump", page 342](#)

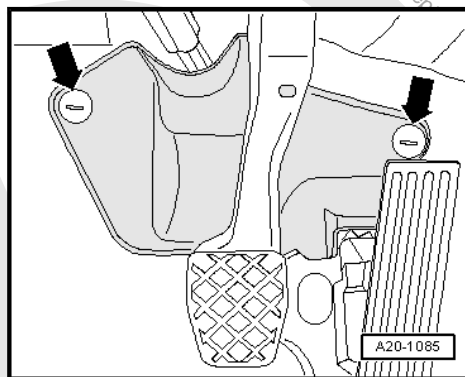
### 4.1 Accelerator Pedal Module

Special tools and workshop equipment required

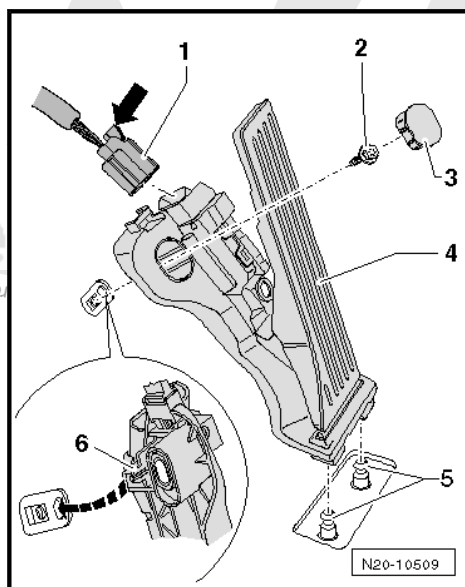
- ◆ Accelerator Pedal Module Release Tool -T10238-

#### Removing

- Remove the steering column cover -arrows-.



- Pry out the cap -3- with a screwdriver

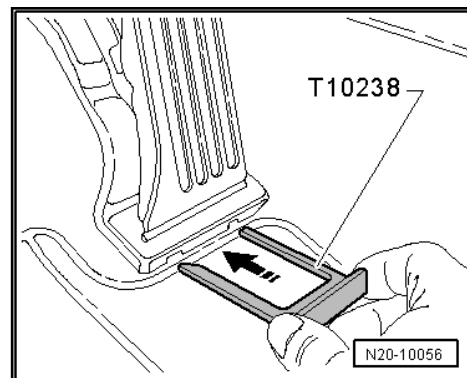


- Remove the bolt -2-.
- Disconnect the connector -1- -arrow- from the accelerator pedal module.



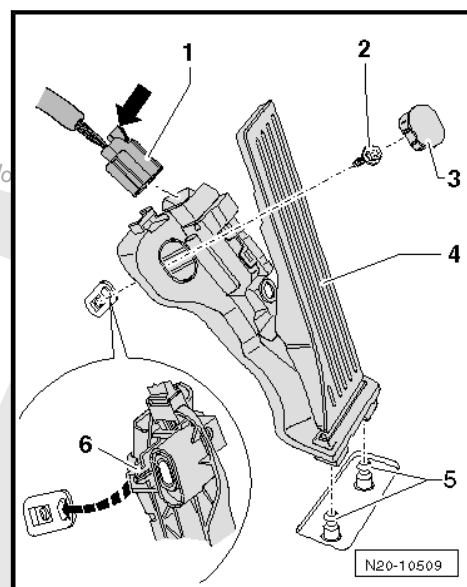


- Push the Accelerator Pedal Module Release Tool -T10238- all the way into the designated openings, as shown, and remove the accelerator pedal module.

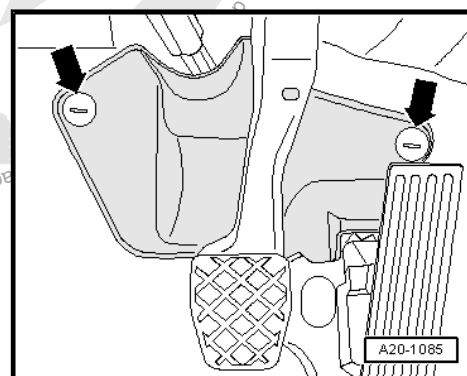


### Installing

- Connect the connector -1- to the accelerator pedal module -4-. Lock the connector -arrow-.



- Press the accelerator pedal module onto the securing pins -5-.
- Insert the centering pin -6- into the hole on the underbody.
- Secure the accelerator pedal module with the bolt -2- and install the cap -3-.
- Install the cover on the steering column.





- If the accelerator pedal module was replaced, adapt it to the Engine Control Module (ECM) using the Vehicle Diagnostic Tester in "Guided Functions".
- If the accelerator pedal module is replaced in a vehicle with a DSG® transmission, then the kick-down function must be adapted using the Vehicle Diagnostic Tester. Refer to Vehicle Diagnostic Tester "Guided Functions".

#### Tightening Specification

Component	Nm
Accelerator pedal module to body	10

## 4.2 EVAP Canister

### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

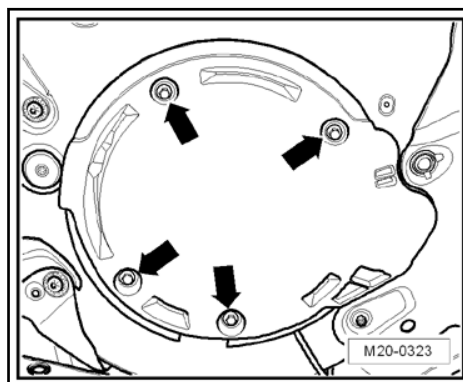


#### Note

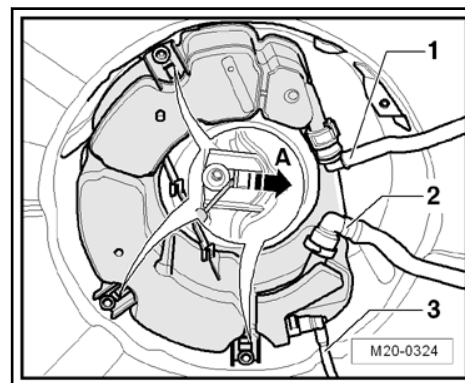
- ◆ *Hose connections are secured with either spring or hose clamps.*
- ◆ *Use Spring-Type Clip Pliers to installing spring clips.*
- ◆ *The fuel hoses on the engine may only be secured with spring clamps. Refer to the Parts Catalog.*

### Removing

- Read the safety precautions before starting. Refer to ➤ [P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to ➤ [f1.1 or Clean Working Conditions", page 1](#) .
- Remove the cover under the spare tire well -arrows-.



- Disconnect the connecting line -1-.



- Pull off the vent lines -2 and 3-.



#### Note

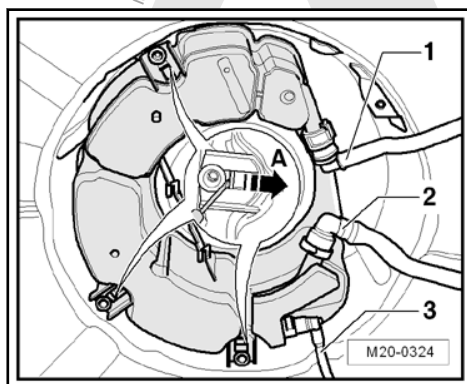
*Press the securing ring to disengage the lines.*

- Using a screwdriver, release the retaining tabs -A- and remove the Evaporative Emission (EVAP) canister.

#### Installing

Install in reverse order of removal. Note the following:

- ◆ Tightening specifications. Refer to [⇒ 2.3.1 EVAP System", page 283](#).
- The vent and connection lines -1 through 3- must engage audibly.



### 4.3 Fuel Delivery Unit/Fuel Level Sensor

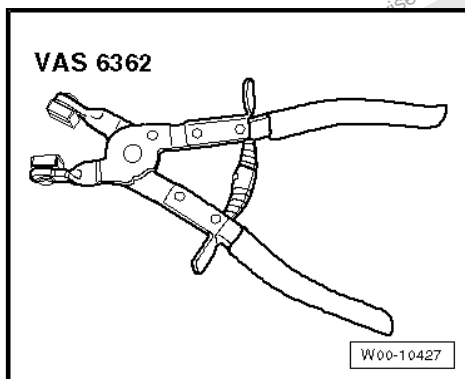
#### Special tools and workshop equipment required

- ◆ Wrench - Fuel Sending Unit -T10202-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Hose Clip Pliers -VAS6362- or Hose Clip Pliers -VAS6340-



#### Note

- ◆ The fuel hoses on the engine may only be secured with spring clamps. Refer to the Parts Catalog.
- ◆ Hose Clip Pliers -VAS6362- or the Hose Clip Pliers -VAS6340- are recommended for installing the spring clamps.



If the fuel delivery unit was replaced, then it will be necessary to adapt the Engine Control Module (ECM) to the fuel pump using the Vehicle Diagnostic Tester.

#### Removing



#### Caution

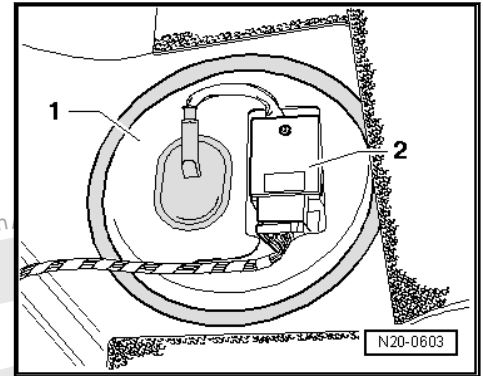
##### Conditions:

- The fuel tank may be a maximum of  $\frac{3}{4}$  full. This ensures the fuel level is below the fuel delivery unit flange.

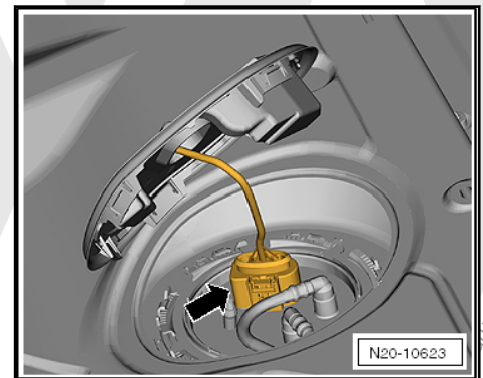


#### Note

- ◆ When replacing the fuel delivery unit, check the fuel tank for visible contamination and clean if necessary.
- ◆ If necessary, empty the fuel tank using the Fuel Extraction Unit -VAG5190-. Refer to ⇒ [T1.1 ank, Draining](#), page 272.
- ◆ Overview - fuel tank. Refer to ⇒ [-2.5 Fuel Tank](#), page 287.
- Read the safety precautions before starting. Refer to ⇒ [P1.2 recautions](#), page 2.
- Follow all the guidelines for clean working conditions. Refer to ⇒ [f1.1 or Clean Working Conditions](#), page 1.
- Switch off the ignition and all electrical consumers and remove the key.
- Remove the bench seat. Refer to ⇒ Body Interior; Rep. Gr. 72; Removal and Installation.
- Unclip the cover -1- with the Fuel Pump Control Module -J538- -2-.



- Pull on the connector -arrow- without pressing the locking mechanism to make sure it is connected securely. If the connector was not connected correctly, it could cause a malfunction.



- Disconnect the connector.
- Check the contacts on the connector and the fuel delivery unit for damage.

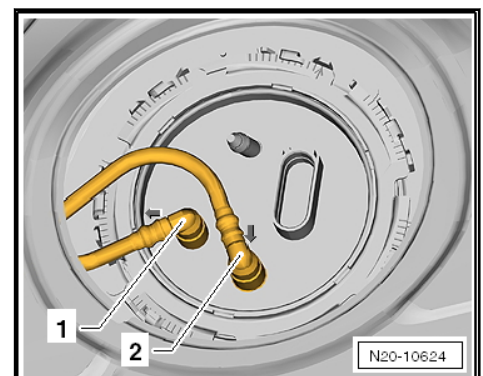


#### WARNING

***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

- Remove the fuel lines -1 and 2- from the flange.

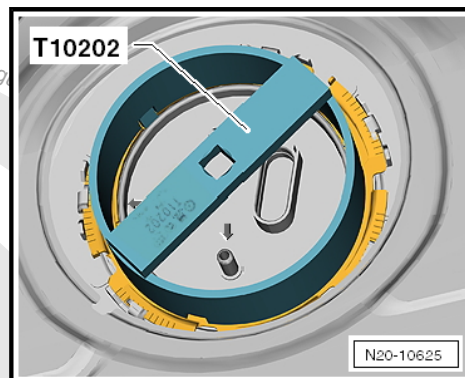




#### Note

*Press in securing ring to disengage the lines.*

- Open the locking ring using the Wrench - Fuel Sending Unit -T10202-.



- Pull the delivery unit and gasket out of the fuel tank opening.



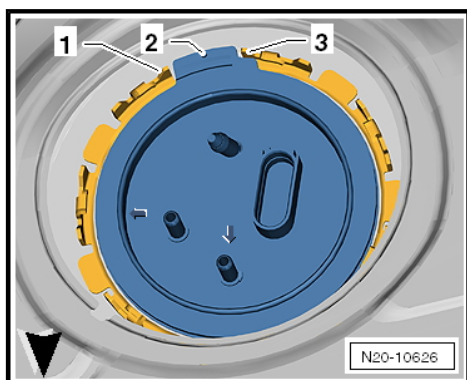
#### Note

- ◆ *When removing fuel delivery unit, be sure not to bend sender for fuel gauge.*
- ◆ *If the fuel delivery unit is being replaced, the old fuel delivery unit must be drained before disposal.*

#### Installing

Installation of fuel delivery unit is the reverse of removal. Note the following:

- ◆ Install the new dry fuel delivery unit seal into the opening in the fuel tank.
- ◆ Coat the seal with fuel only for installing the fuel delivery unit on the inside.
- ◆ Be careful not to bend the fuel level sensor when installing the fuel delivery unit.
- ◆ Press the sealing flange downward against the spring force and bring it into the installation position.
- ◆ Pay attention to the installation position of the fuel delivery unit: the tab -2- on the fuel delivery unit must be between the latches -1- and -3-. The -arrow- points in the direction of travel.







- ◆ Tighten the locking ring to 110 Nm.
- ◆ Do not interchange black supply line and blue return line (arrows on flange of fuel delivery unit).
- ◆ Make sure the connectors and the fuel line are secure. Pull on them if necessary.
- ◆ After installing fuel delivery unit, check whether supply and return lines are still clipped to the fuel tank.

## 4.4 Fuel Filter

### Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-

### Removing

- Read the safety precautions before starting. Refer to ➤ [P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to ➤ [f1.1 or Clean Working Conditions", page 1](#) .



### Note

Overview - fuel filter with attachments. Refer to ➤ [-2.4 Fuel Filter", page 286](#) .

- Place a Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray - VAS6208- under the fuel filter.

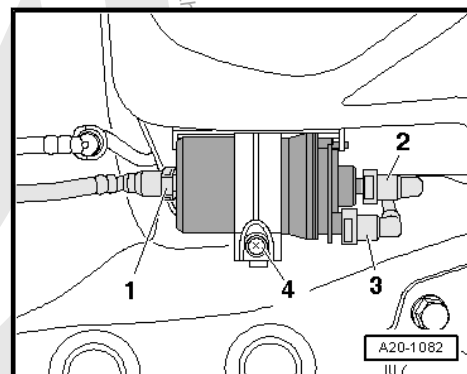


### WARNING

**The fuel system is under pressure!**

- ◆ **Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.**
- ◆ **Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.**

- Disconnect the fuel lines -1, 2 and 3- at the connecting point.







### Note

*Press the locking ring to release the fuel lines.*

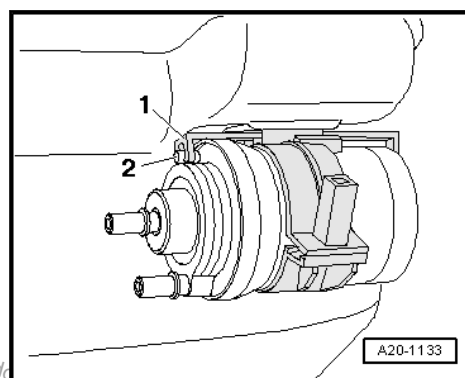
- Remove the bolt -4-.
- Remove fuel filter.

### Installing

Install in reverse order of removal. Note the following:

- ♦ The direction of flow is marked on filter housing with arrows.

### Installation Position of Fuel Filter



The pin -2- on filter housing must engage in recess of the guide  
-1- on filter bracket.

### Tightening Specification:

Component	Nm
Screw clip for fuel filter	3

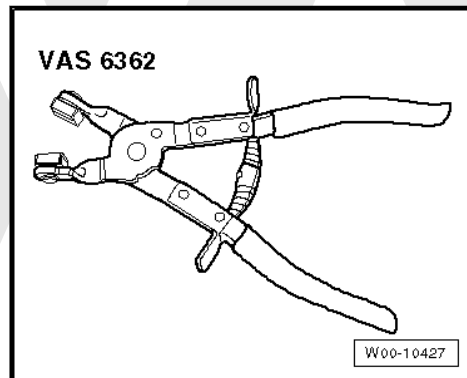


## 4.5 Fuel Level Sensor -G-



### Note

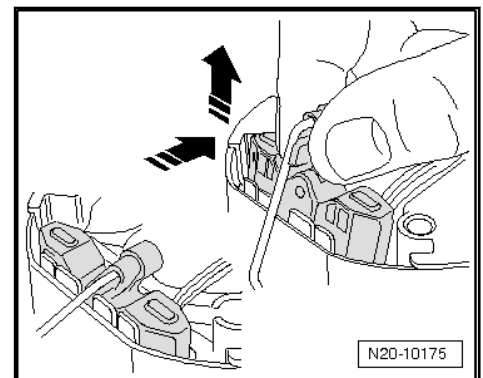
- ◆ The fuel hoses on the engine may only be secured with spring clamps. Refer to the Parts Catalog.
- ◆ Hose Clip Pliers -VAS6362- or the Hose Clip Pliers -VAS6340- are recommended for installing the spring clamps.



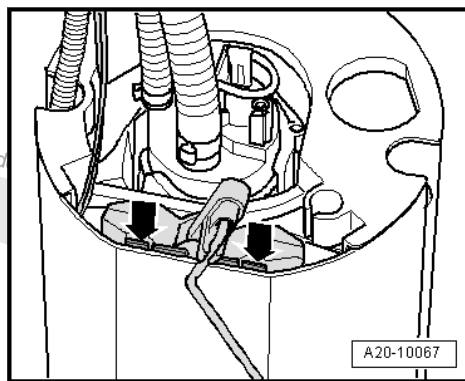
If the fuel delivery unit was replaced, then it will be necessary to adapt the Engine Control Module (ECM) to the fuel pump using the Vehicle Diagnostic Tester.

### Removing

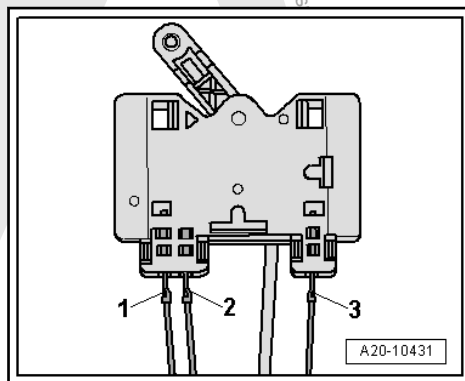
- Read the safety precautions before starting. Refer to ⇒ [P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to ⇒ [f1.1 or Clean Working Conditions", page 1](#) .
- Install the fuel delivery unit. Refer to ⇒ [D4.3 elivery Unit/Fuel Level Sensor", page 331](#) .
- Pull the Fuel Level Sensor -G- slightly to the side and upward at the same time.



- If the sensor cannot be released this way, also press the retaining tab -arrows- to the side slightly.



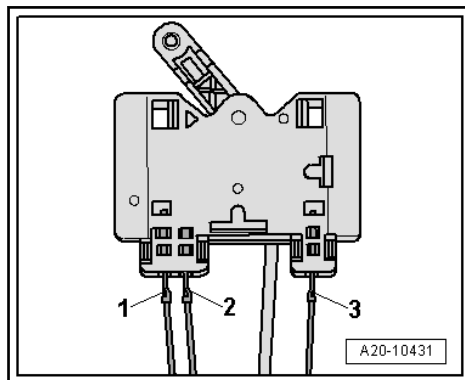
- Note the wire color coding for installing later.



- Release and disconnect the connectors -1 through 3-. Bend the hooks back.

#### Installing

- Connect the connectors -1 through 3-. Pay attention to the color coding.



- Pull on the connector to make sure it is secure.
- Insert the Fuel Level Sensor -G- in the guide on the fuel delivery unit and push down until it engages.
- Install the fuel delivery unit. Refer to ➔ [D4.3 elivery Unit/Fuel Level Sensor](#), page 331 .

## 4.6 Fuel Tank

### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-



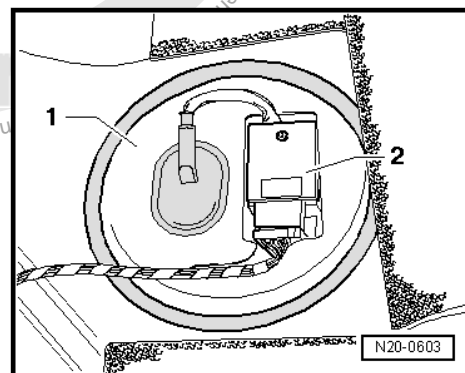
## Removing

- Fuel tank may be a maximum of  $\frac{1}{4}$  full.



### Note

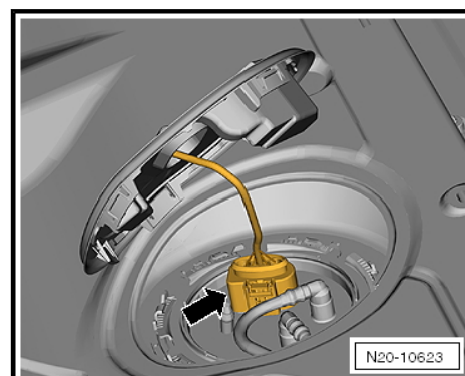
- ◆ If necessary, empty the fuel tank using the Fuel Extraction Unit -VAG5190-. Refer to ⇒ [T1.1 ank, Draining](#), page 272.
- ◆ Read the safety precautions before starting. Refer to ⇒ [P1.2 recautions](#), page 2.
- ◆ Follow all the guidelines for clean working conditions. Refer to ⇒ [f1.1 or Clean Working Conditions](#), page 1.
- Switch off the ignition and all electrical consumers and remove the key.
- Open the fuel filler door and remove the fuel cap.
- Remove the bolts from the fuel filler door unit and then remove the fuel filler door unit. Refer to ⇒ Body Exterior; Rep. Gr. 55; Removal and Installation.
- Remove the bench seat. Refer to ⇒ Body Interior; Rep. Gr. 72; Removal and Installation.
- Remove the cover -1- and Fuel Pump Control Module -J538- -2- from the fuel delivery unit.



### Note

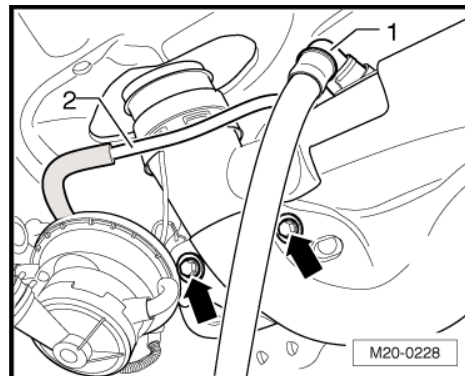
Disconnect the connector from the Metering Pump -V54- if the vehicle has an auxiliary heater.

- Disconnect the connector -arrow-.

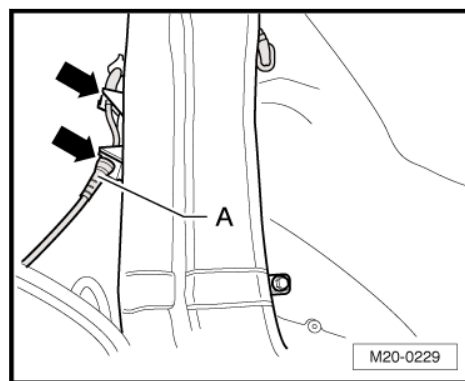




- Remove the right rear wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66; v.
- Clean the surrounding area around the fuel filler tube.
- Separate the connections -1 and 2-.



- Remove the fuel filler tube -arrows-.
- Remove the ABS wire -A- from the bracket -arrows-.



- Remove front muffler, front and rear mufflers must be separated beforehand if necessary. Refer to ➤ [P3.1 ipes/Mufflers, Separating](#), page 443



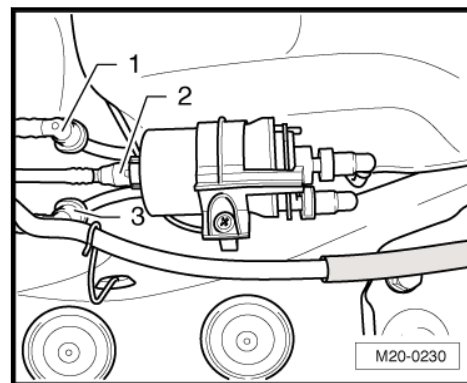
#### WARNING

***The fuel system is under pressure!***

- ◆ ***Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.***
- ◆ ***Wrap a cloth around the wiring connections before loosening hose connections. Then release pressure by carefully pulling off the line.***

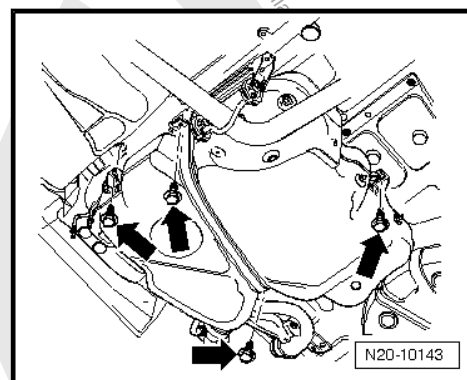
- Disconnect the bleed line from the Evaporative Emission (EVAP) canister's connection behind the fuel tank.
- Disconnect the white vent line -1-, the black supply line -2- and the green vacuum line for the Leak Detection Pump -V144- -3- at the connection point.





#### Note

- ◆ Press in securing ring to disengage the lines.
- ◆ A second technician will be needed to support the fuel tank.
- Remove the mounting strap and bolts -arrows-.
- Remove the fuel tank.



#### Installing

Install in reverse order of removal. Note the following:

- ◆ Only use bolts with loose washers to secure the fuel tank mounting straps. If other bolts are used, the mounting straps could twist when the bolts are tightened.
- ◆ Make sure the vent and fuel lines are routed without kinks.
- ◆ Do not interchange supply and return line (supply line black, return line blue).
- ◆ Make sure the line connections are secure.
- ◆ Check the fuel tank/body Ground (GND) connection on the filler neck.
- ◆ Make sure the lines are still attached to the fuel tank after installing the fuel tank.

#### Tightening Specification

Component	Nm
Fuel tank to body - M 6	11
Fuel tank to body - M 6 ◆ Replace the bolts	26



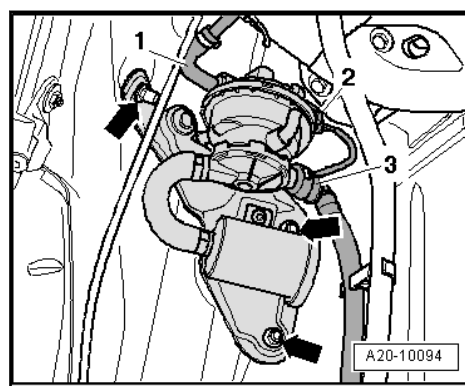
## 4.7 Leak Detection Pump

### Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

### Removing

- Read the safety precautions before starting. Refer to ➤ [P1.2 recautions", page 2](#) .
- Follow all the guidelines for clean working conditions. Refer to ➤ [f1.1 or Clean Working Conditions", page 1](#) .
- Remove the right rear wheel.
- Remove the right rear wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Remove the vacuum line -1- from the Leak Detection Pump - V144-



- Disconnect the connector -2-.
- Remove the connecting line -3-.



### Note

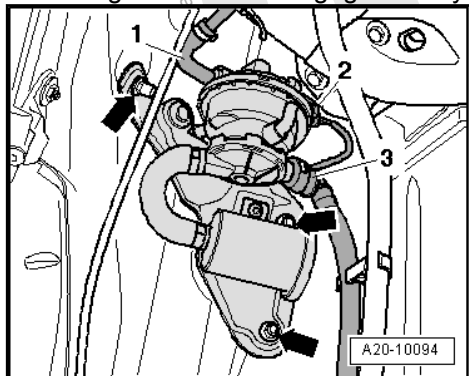
*Press the securing ring to disengage the line.*

- Remove the nuts -arrows-.
- Remove the Leak Detection Pump -V144- and bracket.

### Installing

Install in reverse order of removal. Note the following:

- ◆ Tightening specification. Refer to ➤ [-2.3.1 EVAP System", page 283](#) .
- The connecting line -3- must engage audibly.

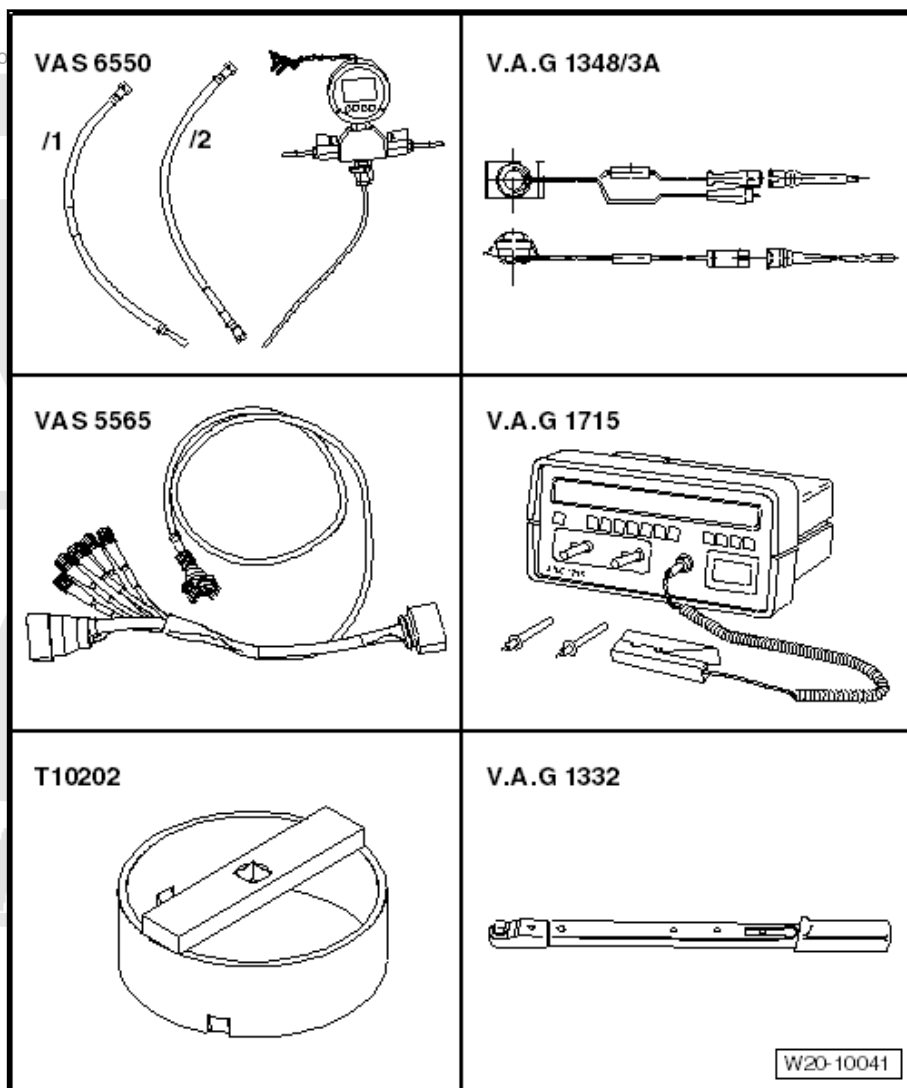







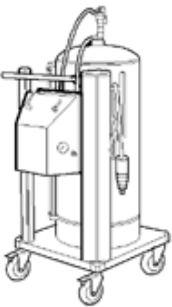
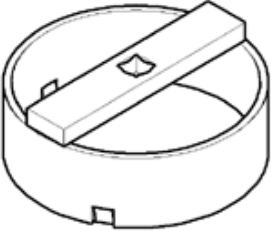
## 5 Special Tools

### Special tools and workshop equipment required

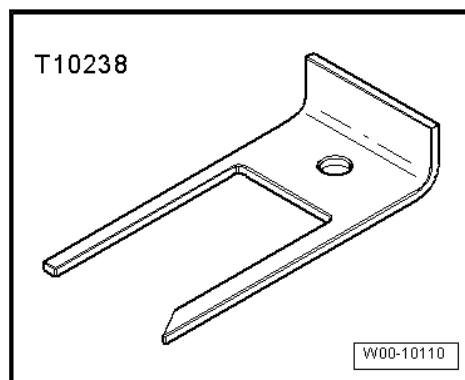


- ◆ Pressure Tester Kit -VAS6550-
- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-
- ◆ Analog/Digital Multimeter -FLU83III-
- ◆ Wrench - Fuel Sending Unit -T10202-
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-



<b>V.A.G 1332</b> 	<b>VAS 5190</b> 
<b>T10202</b> 	
	<b>I20-0003</b>

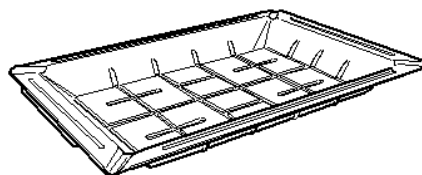
- ◆ Torque Wrench 1332 40-200Nm -VAG1332-
- ◆ Fuel Extraction Unit -VAS5190-
- ◆ Wrench - Fuel Sending Unit -T10202-
- ◆ Accelerator Pedal Module Release Tool -T10238-





- ◆ Drip Tray For VAG1202A -VAG1306- or Shop Crane - Drip Tray -VAS6208-

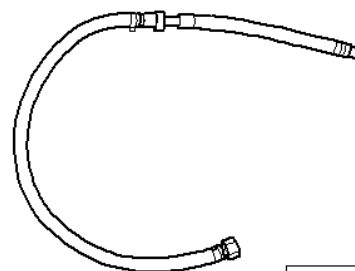
**VAS 6208**



W00-10228

- ◆ Fuel Injection Gauge Kit - Adapter Set -VAG1318/17A-

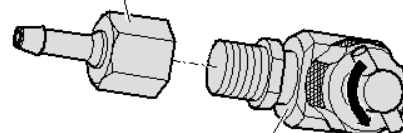
**V.A.G 1318/17A**



W00-10560

- ◆ Fuel Injection Gauge Kit - Fuel Bleeder 20 Adapter 1 - VAG1318/20-1-

**V.A.G 1318/20-1**



**V.A.G 1318/20**

N20-0528

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

**V.A.G 1331**



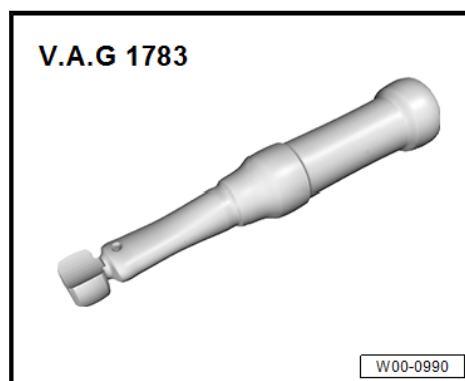
W00-0427



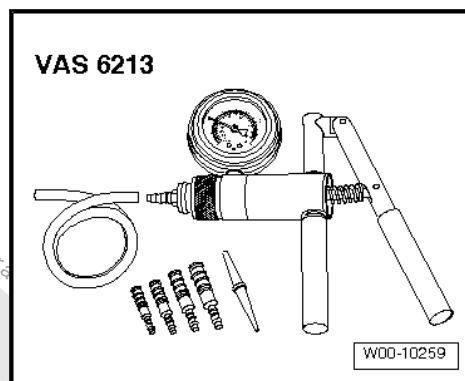
◆ Turbocharger Tester Kit - VAG1397A-



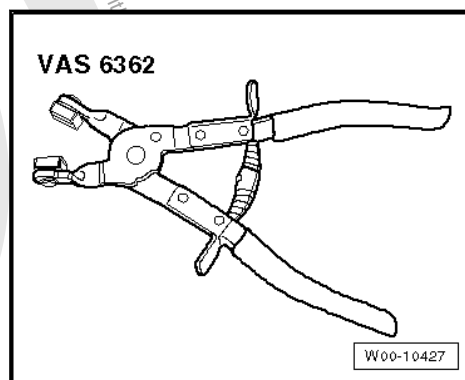
◆ Torque Wrench 1783 - 2-10Nm -VAG1783-



◆ Hand Vacuum Pump -VAS6213-

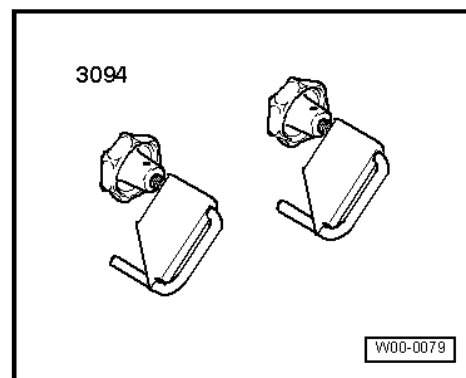


◆ Hose Clip Pliers -VAS6362- or Hose Clip Pliers -VAS6340-

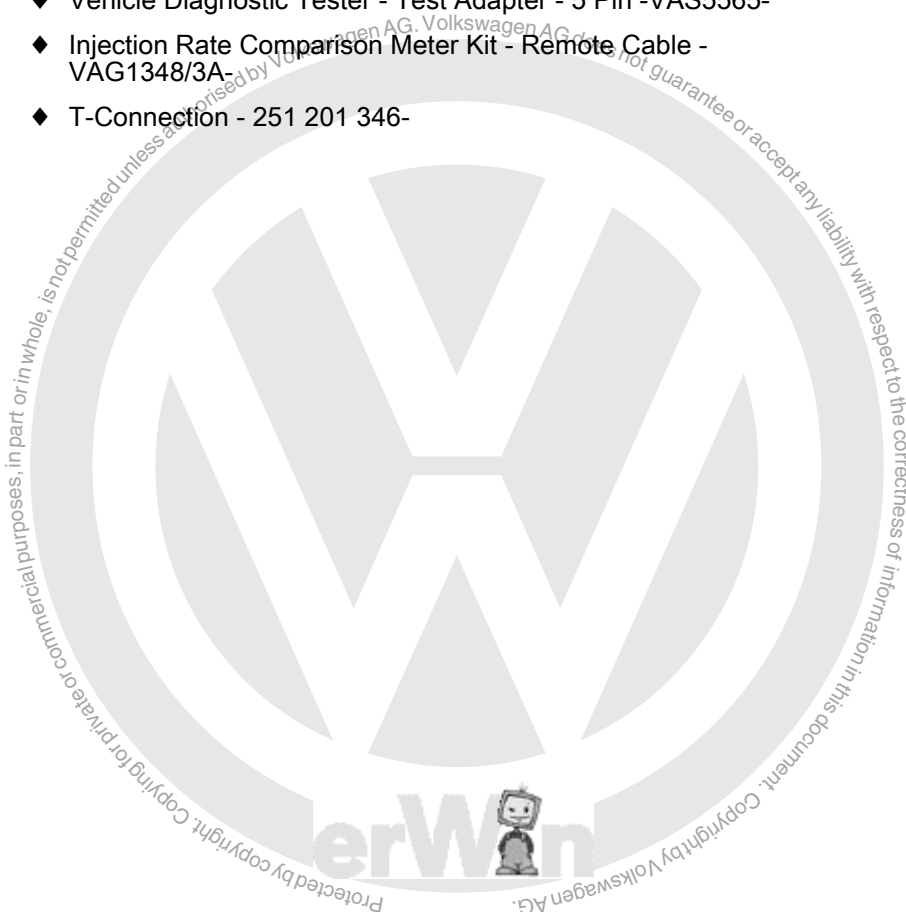




- ◆ Hose Clamps - Up To 2 mm -3094-



- ◆ Not illustrated:
- ◆ Evaporative Emissions Tester -KLI9210-
- ◆ Evaporative Emissions Tester - Adapter 55 - Adapter Hose -KLI9210/55-1-
- ◆ Connector Test Set -VAG1594C-
- ◆ Fuel Extraction - Adapter 3 -VAS5190/3-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 5 Pin -VAS5565-
- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ T-Connection - 251 201 346-





## 21 – Turbocharger, Supercharger

### 1 Description and Operation

⇒ [C1.1 onnections with Connector Couplings, Assembling](#),  
[page 348](#)

⇒ [-1.2 Charge Air System](#), [page 349](#)

⇒ [-1.3 Turbocharger](#), [page 350](#)

⇒ [O1.4 verview - Charge Air System](#), [page 357](#)

#### 1.1 Hose Connections with Connector Couplings, Assembling

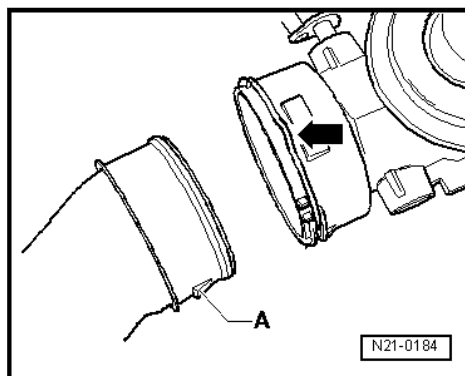


##### Caution

*The connector coupling sealing ring can be damaged if securing clamp is in locked position when installing. This would result in a leak. Follow the assembly instructions.*

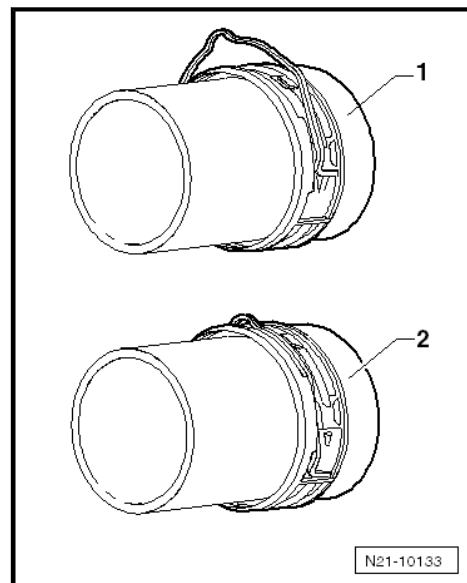
##### Removing

- Release the connector coupling by pulling locking clip -arrow-. Disconnect the hose/tube without assistance from tools.



##### Installing

- When replacing sealing ring, lay ring in charge air hose groove. Make sure the gasket is seated in the groove and that it is not twisted.
- Oil the sealing surfaces and the gasket.
- Bring the securing clip into the release position -1-.



- Slide the charge air hose into clutch until it stops.
- Bring the securing clip into the lock position -2- and then press the charge air hose back again.
- Check for correct seating and proper locking of connector by pulling on the hose.

## 1.2 Overview - Charge Air System



### Caution

***The charge air pipe clamps must be tightened to 5.5 Nm. An insufficient or excessive tightening torque can cause the charge air hose to come off the charge air pipe while driving.***





**1 - Bolt**

- 5 Nm

**2 - Bearing**

- For the charge air cooler

**3 - Charge Air Cooler**

- Removing and installing. Refer to [⇒ A3.1 in Cooler](#), page 364 .

**4 - Charge Air Pipe**

**5 - Bolt**

- 10 Nm

**6 - Charge Air Hose**

- Assembly of hose connections with connection couplings. Refer to [⇒ C1.1 onnections with Connector Couplings, Assembling](#), page 348 .

**7 - Charge Air Pipe**

- To the sound generator

**8 - Charge Air Hose**

- Assembly of hose connections with connection couplings. Refer to [⇒ C1.1 onnections with Connector Couplings, Assembling](#), page 348 .

**9 - Hose Clamp**

**10 - Charge Air Hose**

- To the Throttle Valve Control Module -J338-

**11 - Charge Air Hose**

**12 - Charge Air Pipe**

**13 - Charge Air Hose**

**14 - Bolt**

- 8 Nm

**15 - Sound Generator**

**16 - Charge Air Pipe**

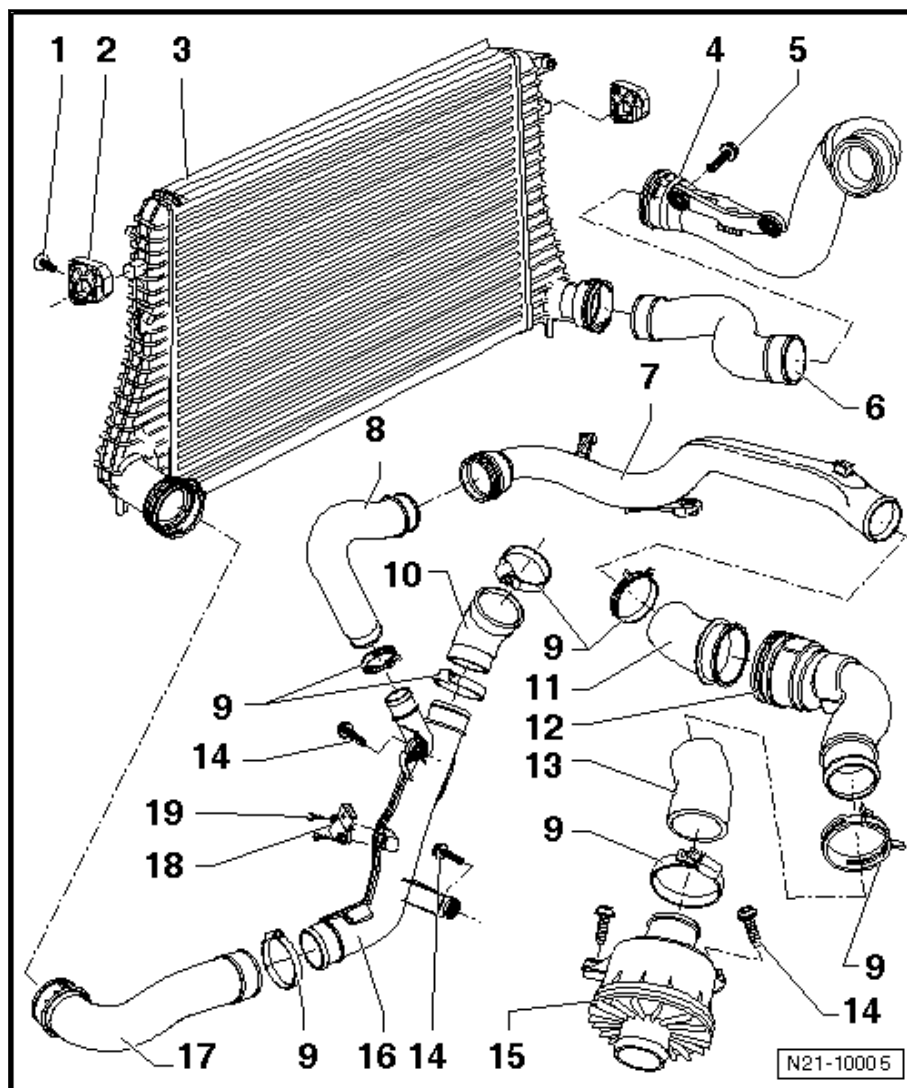
**17 - Charge Air Hose**

- Assembly of hose connections with connection couplings. Refer to [⇒ C1.1 onnections with Connector Couplings, Assembling](#), page 348 .

**18 - Charge Air Pressure Sensor -G31-**

**19 - Bolt**

- 5 Nm



## 1.3 Overview - Turbocharger

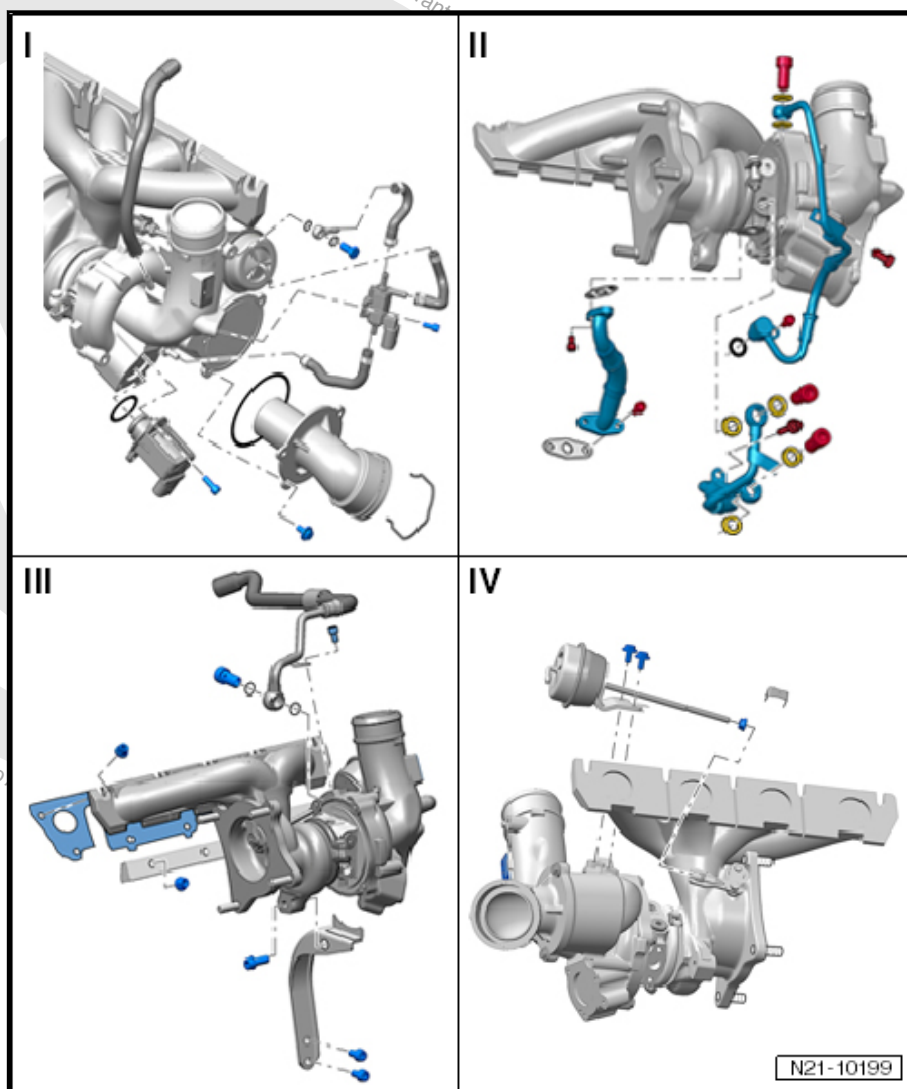


Part I - Refer to ➤ [I1.3.1](#),  
[page 351](#)

Part II - Refer to ➤ [I1.3.2 I](#),  
[page 353](#)

Part III - Refer to ➤ [I1.3.3 II](#),  
[page 354](#)

Part IV - Refer to ➤  
[r1.3.4 eplacePart IV](#)", [page 356](#)



## 1.3.1 Part I



### 1 - Turbocharger

- ☐ Can be replaced only with the exhaust manifold
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.
- ☐ Removing and installing. Refer to ➤ [3.2](#), [page 367](#).

### 2 - Connecting Hose

- ☐ Make sure it is secure

### 3 - Charge Air Pressure Regulation Vacuum Diaphragm

- ☐ Checking. Refer to ➤ [V2.2 Vacuum Diaphragm, Checking](#), [page 361](#).
- ☐ Removing and installing. Refer to ➤ [V3.3 Vacuum Diaphragm Replacing](#), [page 374](#).

### 4 - Connecting Hose

- ☐ Make sure it is secure

### 5 - Connecting Hose

- ☐ Make sure it is secure

### 6 - Bolt

- ☐ 3 Nm

### 7 - Wastegate Bypass Regulator Valve -N75-

### 8 - Connecting Hose

- ☐ Make sure it is secure

### 9 - Connection

### 10 - Clip

### 11 - Bolt

- ☐ 9 Nm

### 12 - Gasket

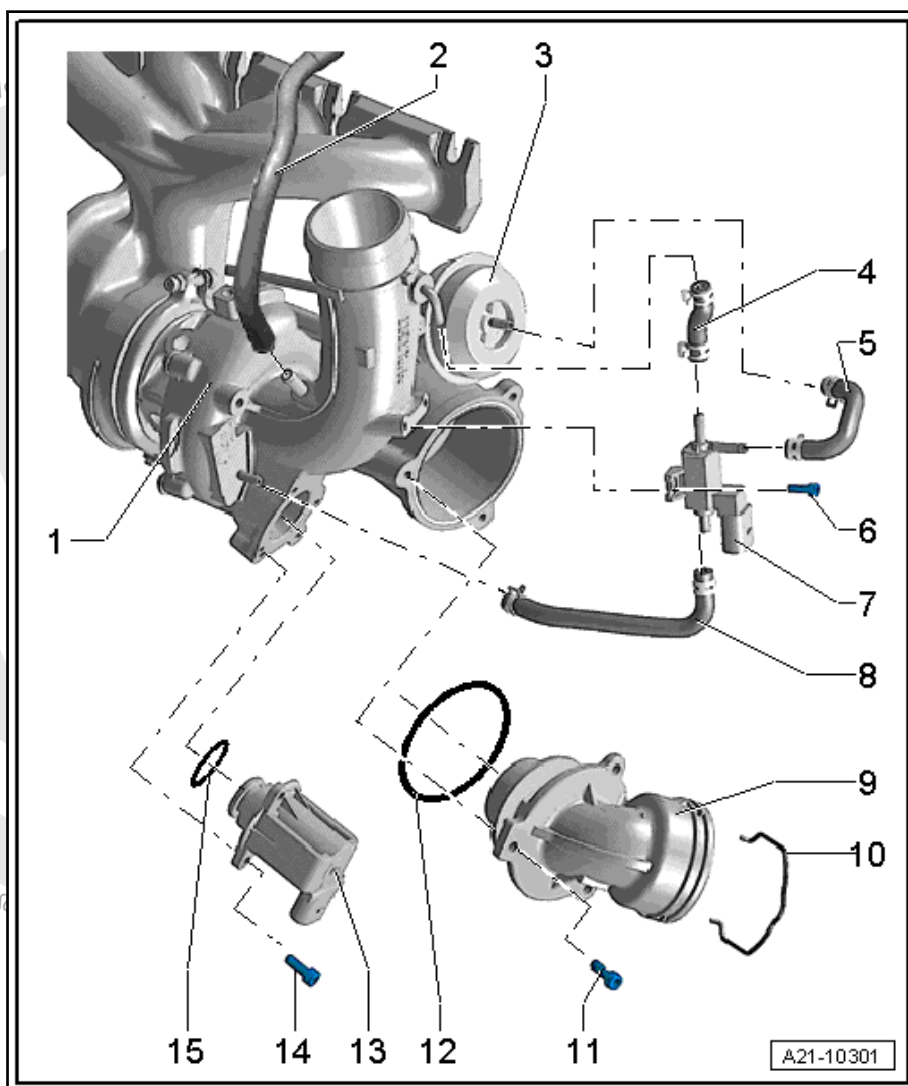
### 13 - Turbocharger Recirculation Valve -N249-

- ☐ Note the installation position. Refer to ➤ [Fig. "" Turbocharger Recirculation Valve -N249- Installation Position""](#), [page 352](#).

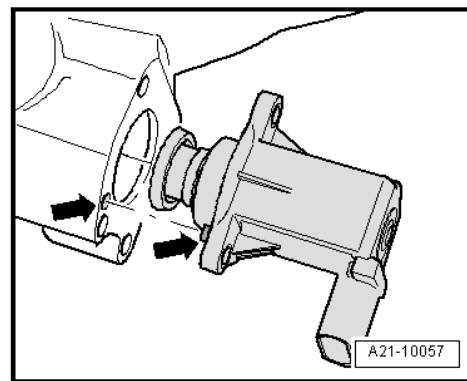
### 14 - Bolt

- ☐ 7 Nm

### 15 - Gasket



### Turbocharger Recirculation Valve -N249- Installation Position



- Note the installation location -arrows-.

### 1.3.2 Part II





**1 - Gasket**

- ☐ Always replace

**2 - Banjo Bolt**

- ☐ 33 Nm

**3 - Oil Supply Line**

**4 - Turbocharger**

- ☐ Can be replaced only with the exhaust manifold
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste! Refer to the Parts Catalog.
- ☐ Removing and installing. Refer to ➤ [3.2](#), [page 367](#)

**5 - Bolt**

- ☐ 9 Nm

**6 - Bolt**

- ☐ 9 Nm

**7 - Gasket**

- ☐ Always replace

**8 - Banjo Bolt**

- ☐ 38 Nm

**9 - Bolt**

- ☐ 9 Nm

**10 - Banjo Bolt**

- ☐ 38 Nm

**11 - Gasket**

- ☐ Always replace

**12 - Coolant Supply Line**

**13 - O-Ring**

- ☐ Always replace

**14 - Bolt**

- ☐ 9 Nm

**15 - Seal**

- ☐ Always replace

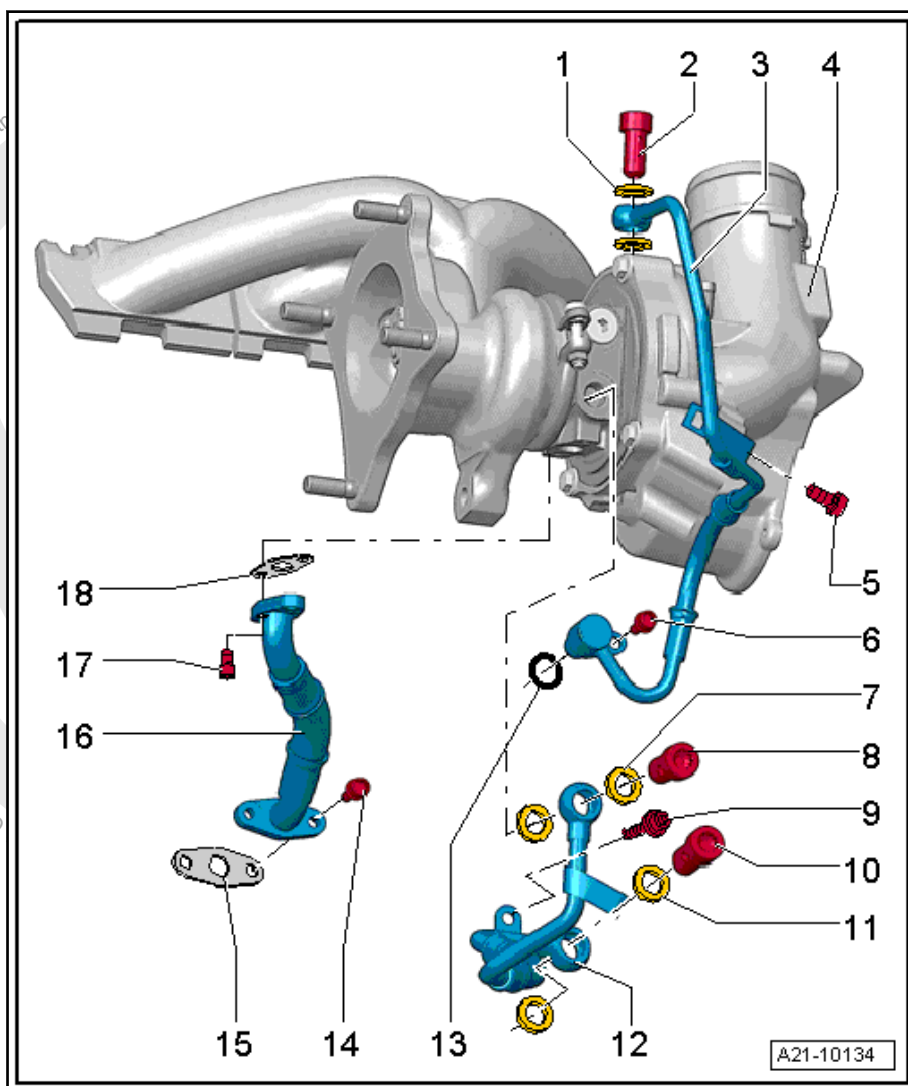
**16 - Oil Return Line**

**17 - Bolt**

- ☐ 9 Nm

**18 - Seal**

- ☐ Always replace



### 1.3.3 Part III



### 1 - Seal

- ☐ Always replace

### 2 - Nut

- ☐ Tightening sequence and specification. Refer to ➤ [Fig. "Turbocharger - Tightening Sequence and Specification", page 355](#).
- ☐ Always replace
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.

### 3 - Banjo Bolt

- ☐ 38 Nm

### 4 - Gasket

- ☐ Always replace

### 5 - Coolant Supply Line

### 6 - Bolt

- ☐ 9 Nm

### 7 - Turbocharger

- ☐ Can be replaced only with the exhaust manifold
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.
- ☐ Removing and installing. Refer to ➤ [3.2, page 367](#).

### 8 - Bracket

### 9 - Bolt

- ☐ 30 Nm
- ☐ Coat bolt with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.

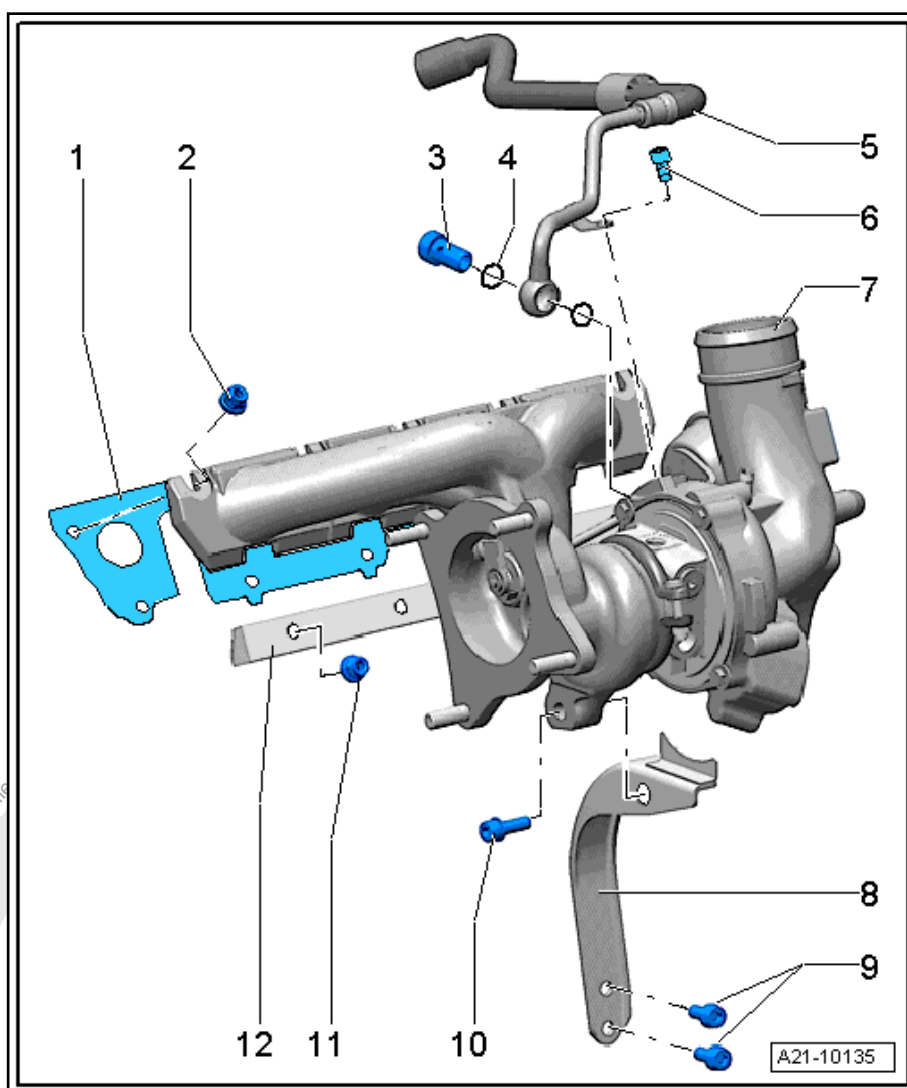
### 10 - Bolt

- ☐ 30 Nm
- ☐ Coat bolt with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.

### 11 - Nut

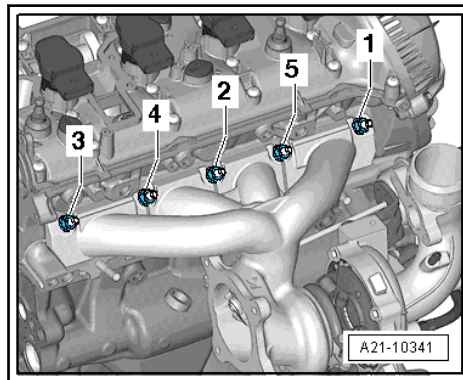
- ☐ 30 Nm
- ☐ Always replace
- ☐ Do not loosen to remove turbocharger
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.

### 12 - Clamping Strip



## Turbocharger - Tightening Sequence and Specification





### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Torque Wrench 1783 2-10Nm -VAG1783-

### Procedure

- Tighten nuts in 4 stages in -1 to 5- sequence as follows:

1. Tighten the nuts to 5 Nm.
2. Tighten the nuts to 12 Nm.
3. Tighten the nuts to 16 Nm.
4. Tighten the nuts to 25 Nm.

### 1.3.4 Always replace Part IV





### 1 - Turbocharger

- ☐ Can be replaced only with the exhaust manifold
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.
- ☐ Removing and installing. Refer to [⇒ 3.2, page 367](#).

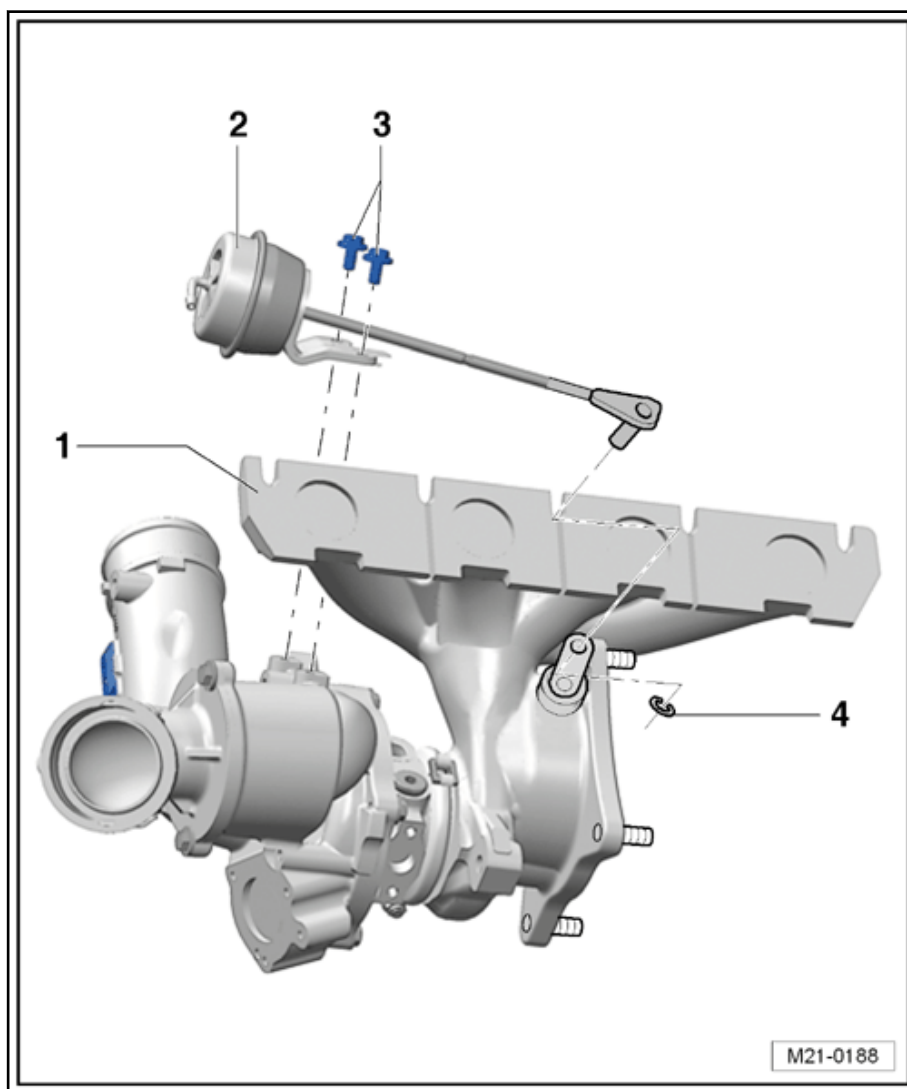
### 2 - Charge Air Pressure Regulation Vacuum Diaphragm

- ☐ Checking. Refer to [⇒ V2.2 Vacuum Diaphragm, Checking](#), page 361.
- ☐ Removing and installing. Refer to [⇒ V3.3 Vacuum Diaphragm, Replacing](#), page 374.

### 3 - Bolt

- ☐ 10 Nm

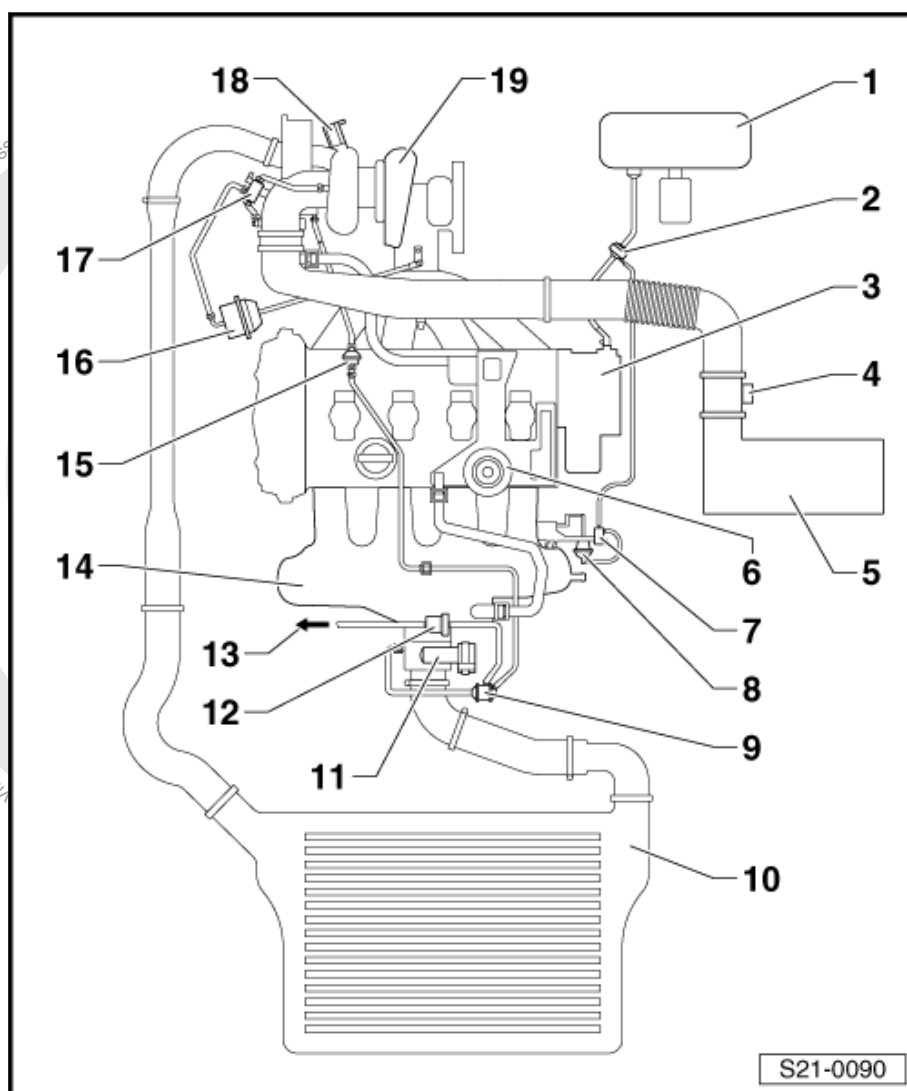
### 4 - Circlip



## 1.4 Schematic Overview - Charge Air System



- 1 - Brake Booster
- 2 - Check Valve
- 3 - Vacuum Pump
- 4 - Mass Airflow Sensor -G70-
- 5 - Air Filter
- 6 - Pressure Regulating Valve
  - ☐ For the crankcase ventilation
- 7 - Intake Manifold Tuning Valve -N156-
- 8 - Vacuum Diaphragm for the Intake Manifold Change-Over
- 9 - Double Check Valve
  - ☐ Checking. Refer to [⇒ C3.1 heck-Valve, Checking", page 294](#) .
- 10 - Charge Air Cooler
- 11 - Throttle Valve Control Module -J338-
- 12 - EVAP Canister Purge Regulator Valve 1 -N80-
- 13 - To Evaporative Emission (EVAP) Canister
- 14 - Intake Manifold
- 15 - Check Valve
- 16 - Charge Air Pressure Regulation Vacuum Diaphragm
- 17 - Wastegate Bypass Regulator Valve -N75-
- 18 - Turbocharger Recirculation Valve -N249-
- 19 - Turbocharger





## 2 Diagnosis and Testing

⇒ **A2.1** **ir System, Checking for Leaks", page 359**

⇒ **V2.2** **acuum Diaphragm, Checking", page 361**

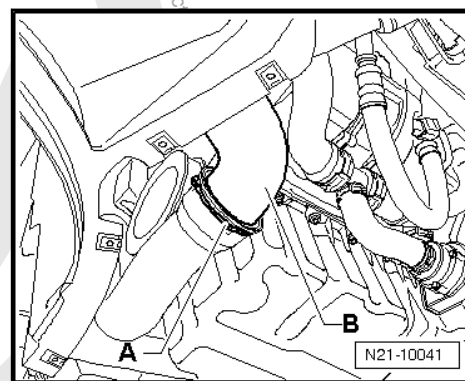
### 2.1 Charge Air System, Checking for Leaks

#### Special tools and workshop equipment required

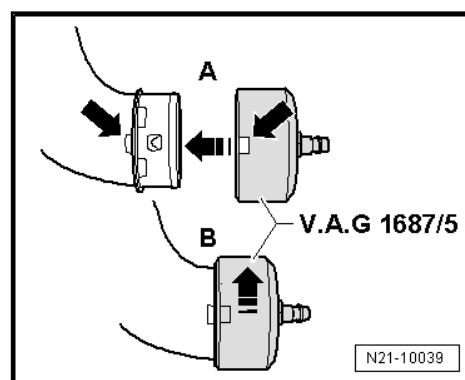
- ◆ Turbo System Tester Kit - VAG1687- with Turbo System Tester Kit - Adapter 5 -VAG1687/5-
- ◆ Ultrasonic Tester - VAG1842- or commercially available leak detection spray

#### Test Sequence

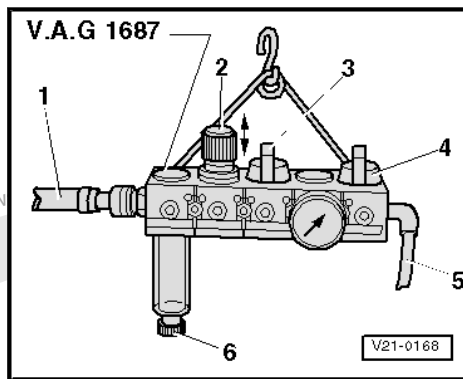
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.
- Release the securing clip -A- and disconnect the hose -B- from the charge air pipe.



- Connect Turbo System Tester Kit - Adapter 5 -VAG1687/5- to the charge air hose -A- and rotate it around approximately 90° -B-.



Prepare the Turbo System Tester Kit -VAG1687- as follows:



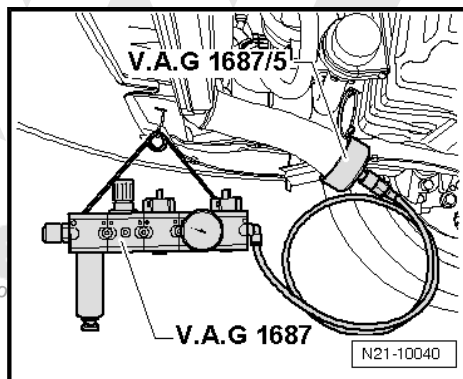
- Turn the pressure regulating valve -2- counterclockwise until it stops.
- Close the valves -3 and 4-.



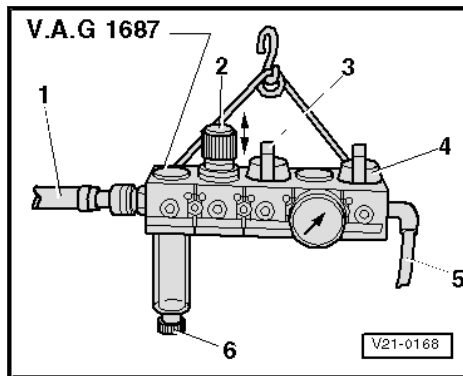
**Note**

*In order to be able to turn pressure regulator valve -2-, the rotary knob must be pulled upward.*

- Connect the Turbo System Tester Kit -VAG1687- as shown:



- Connect the pressure hose -1- (pressurized air supply) to the Turbo System Tester Kit -VAG1687-.



**Note**

*If water is located in viewing glass, drain it via the water drain plug -6-.*

- Open the valve -3-.



- Set pressure to 0.5 bar (7.2 psi) using the pressure regulating valve -2-.



#### Caution

***Pressure must not exceed 0.5 bar (7.2 psi)! A pressure set too high may damage the engine.***

- Open the valve -4- and wait until the testing circuit has filled. If necessary, continue to regulate the pressure to 0.5 bar (7.2 psi).
- Check the charge air system for leaks by listening, feeling and using a commercially available leak detection spray or using the Ultrasonic Tester -VAG1842S-.



#### Note

- ◆ *Assembly of hose connections with connection couplings. Refer to ➔ [C1.1 onnections with Connector Couplings, Assembly](#), page 348.*
- ◆ *A small quantity of air dissipates via the valves in the engine. For this reason a pressure retention test is not possible.*
- ◆ *Information on the Ultrasonic Tester -VAG1842S-. Refer to the Operating Instructions.*
- ◆ *Before removing the adapter, discharge the pressure in testing circuit by pulling off the coupling from the Turbo System Tester Kit - Adapter 5 -VAG1687/5-.*
- ◆ *Hose connections and charge air system hoses must be free of oil and grease before installing.*

## 2.2 Turbocharger Vacuum Diaphragm, Checking

### Special tools and workshop equipment required

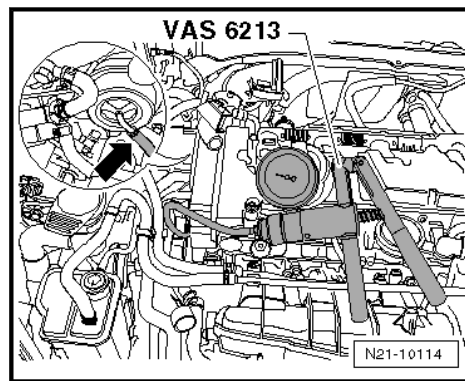
- ◆ Hand Vacuum Pump -VAS6213-

### Test Conditions

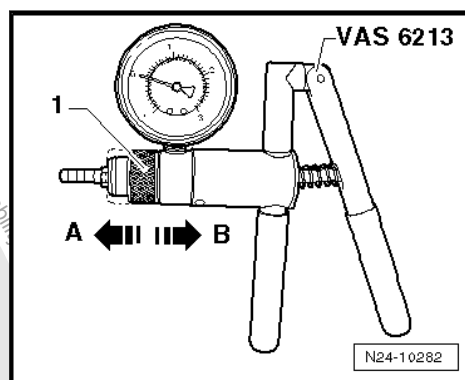
- The hose from the turbocharger over Wastegate Bypass Regulator Valve -N75- must have flow to the vacuum diaphragm.
- Wastegate Bypass Regulator Valve -N75- OK

### Test Sequence

- Remove the engine cover. Refer to ➔ [C3.1 over](#), page 17.
- Connect the Hand Vacuum Pump -VAS6213- to the vacuum diaphragm -arrow-.



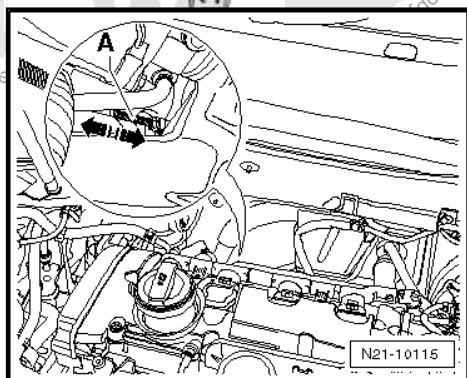
- Set the slide ring -1- on Hand Vacuum Pump -VAS6213- to position -B- for “vacuum”.



#### Caution

*The pressure must not exceed 750 mbar (10.8 psi). If the pressure is exceeded, the vacuum diaphragm can be damaged.*

- Operate the Hand Vacuum Pump -VAS6213- several times and observe the linkage while doing so.
- The linkage -A- must move approximately 300 mbar (4.35 psi) and be at approximately 700 mbar (10.15 psi) at end position.



- The linkage stroke is approximately 10 mm.

If pressure cannot be built up with Hand Vacuum Pump -VAS6213- or pressure falls again immediately:

- Check the Hand Vacuum Pump -VAS6213- and the connecting hoses for leaks.



If no error can be found:

- Replace vacuum diaphragm. Refer to [⇒ V3.3 Vacuum Diaphragm, Replacing](#), page 374 .







### 3 Removal and Installation

⇒ [A3.1 ir Cooler", page 364](#)

⇒ [3.2 , page 367](#)

⇒ [V3.3 acuum Diaphragm, Replacing", page 374](#)

#### 3.1 Charge Air Cooler

Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Cable Tie



#### Caution

*The charge air pipe clamps must be tightened to 5.5 Nm. An insufficient or excessive tightening torque can cause the charge air hose to come off the charge air pipe while driving.*

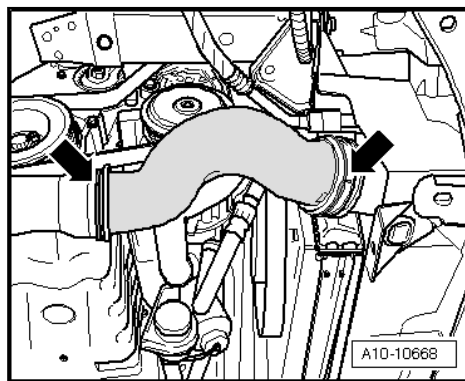


#### Note

- ◆ *Hose connections and charge air system hoses must be free of oil and grease before installing. Only on connector couplings, the gasket and sealing surfaces must be lightly oiled. Refer to ⇒ [C1.1 onnections with Connector Couplings, Assembling", page 348](#) .*
- ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*
- ◆ *The charge air system must be properly sealed.*
- ◆ *Use Spring-Type Clip Pliers to installing spring clips.*

#### Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the bumper cover. Refer to "Front Bumper" in ⇒ Body Exterior; Rep. Gr. 63; Removal and Installation.
- Drain the coolant. Refer to ⇒ [D1.1 raining and Filling", page 229](#) .
- Remove the right charge air hose -arrows-.



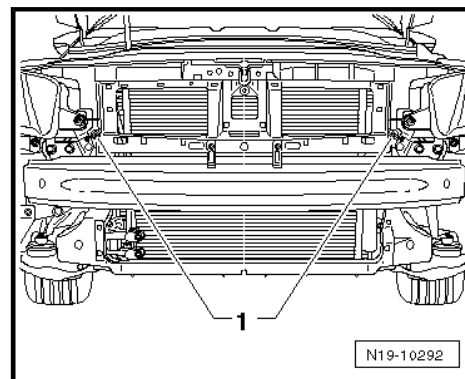
- Remove the fan shroud. Refer to ⇒ [S4.8 hroud with Coolant Fan", page 259](#) .



- Remove the radiator. Refer to ➤ 4.10 , page 264 .

#### Vehicles without Air Conditioning (A/C)

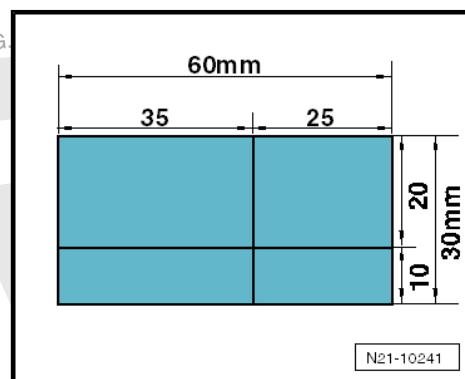
- Remove the charge air cooler bracket bolts -1-.
- Push the charge air cooler toward the rear and remove the bearings that are on the side.
- Lift the charge air cooler out of the lower mounting.
- Remove the charge air cooler downward.



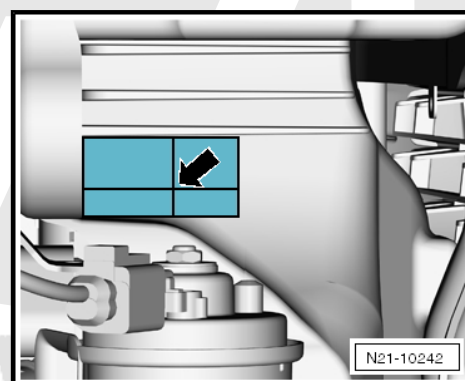
#### Vehicles with A/C System

The condenser pipes are bolted to the right side of the charge air cooler. To remove the bolt, proceed as follows:

- Create a paper template with the specified dimensions.



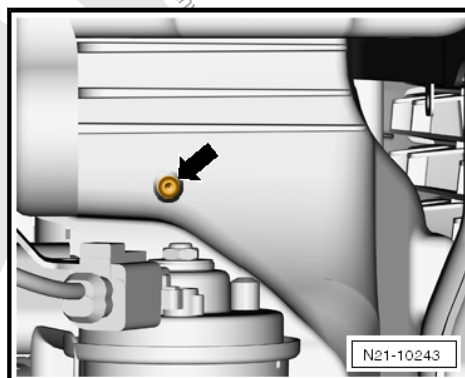
- Position the template on the right front plastic support so it aligns with the top and left edges.



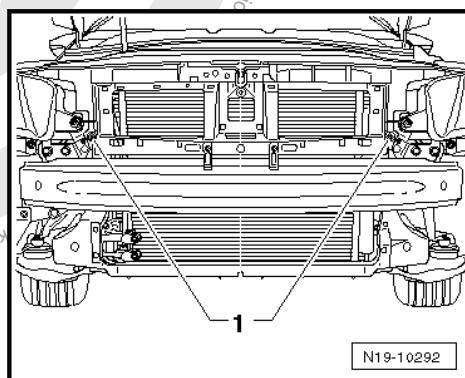
- Mark the cutting point on the template -arrow- with a punch.
- Drill a hole in the plastic support with a 5 mm drill.
- Drill or cut the hold to 16 mm.



- Remove the bolt -arrow- for the condenser pipes.



- Remove the charge air cooler bracket bolts -1-.



- Push the charge air cooler toward the rear and remove the bearings that are on the side.



#### Caution

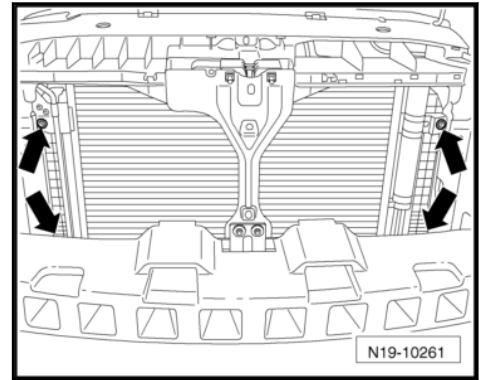
*To prevent damage to the condenser and the refrigerant lines, do not stretch, kink or bend the pipes and hoses.*



#### Note

*The condenser bolts are difficult to access. With the help of a second technician, lift the charge air cooler out of the lower radiator mounts. Now the charge air cooler can be pivoted »back and forth« and the bolts are accessible.*

- Remove the condenser from the charge air cooler -arrows-.
- Secure the condenser to the lock carrier with cable ties.
- Remove the charge air cooler downward.



## Installing



### Caution

*The charge air pipe clamps must be tightened to 5.5 Nm. An insufficient or excessive tightening torque can cause the charge air hose to come off the charge air pipe while driving.*

- ◆ For tightening specifications. Refer to ➤ [-1.2 Charge Air System](#), page 349.

Install in reverse order of removal. Note the following:

- ◆ Hose connections and charge air system hoses must be free of oil and grease before installing. Only on connector couplings, the gasket and sealing surfaces must be lightly oiled. Refer to ➤ [C1.1 connections with Connector Couplings, Assembling](#), page 348.
- ◆ Install only approved clamps for securing hose connections. Refer to the Parts Catalog.
- ◆ Assembly of hose connections with connection couplings. Refer to ➤ [C1.1 connections with Connector Couplings, Assembling](#), page 348.

## 3.2 Turbocharger

### Special tools and workshop equipment required

- ◆ Bits for VAG1331/13 -T10099-
- ◆ Socket - Xzn 10 -T10154-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Spring Clip Pliers
- ◆ Engine Bung Set -VAS6122-
- ◆ Hot Bolt Paste. Refer to the Parts Catalog.





## Note

- ◆ *Hose connections and charge air system hoses must be free of oil and grease before installing. Only on connector couplings, the gasket and sealing surfaces must be lightly oiled. Refer to ⇒ [C1.1 onnections with Connector Couplings, Assembling](#), page 348 .*
- ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*
- ◆ *The charge air system must be properly sealed.*
- ◆ *Replace the self-locking nuts.*
- ◆ *Use Spring-Type Clip Pliers to installing spring clips.*
- ◆ *Assembly of hose connections with connection couplings. Refer to ⇒ [C1.1 onnections with Connector Couplings, Assembling](#), page 348 .*
- ◆ *Fill the turbocharger with engine oil at the connection for oil supply line.*
- ◆ *After installing turbocharger, let engine idle for approximately one minute without increasing engine speed. This ensures adequate oil supply to the turbocharger.*



## Caution

*If mechanical damage is found on the turbocharger, for example a destroyed compression wheel, it is not enough to just replace the turbocharger. Perform the following steps to prevent subsequent damage.*

- ◆ *Clean all oil lines.*
- ◆ *Change the engine oil and the oil filter.*
- ◆ *Check the air filter housing, the air filter element and the intake hoses for contamination.*
- ◆ *Check entire charge air circuit and charge air cooler for foreign objects.*

*If foreign objects are found in charge air circuit, the circuit must be cleaned and the cooler replaced if necessary.*

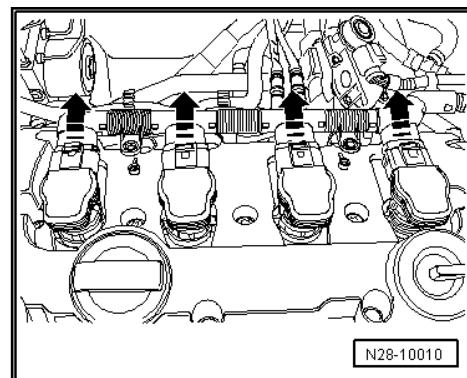
*The oil supply pipe must be replaced when installing a new turbocharger.*

## Removing

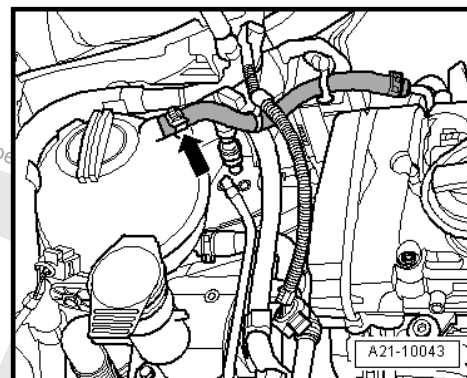
- Remove the engine cover. Refer to ⇒ [C3.1 over](#), page 17 .
- Remove the air filter. Refer to ⇒ [F4.2 ilter Housing](#), page 404 .
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66; Noise Insulation; Noise Insulation Removing and Installing.
- Remove right front wheel.
- Remove the right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Drain the coolant. Refer to ⇒ [D1.1 raining and Filling](#), page 229 .



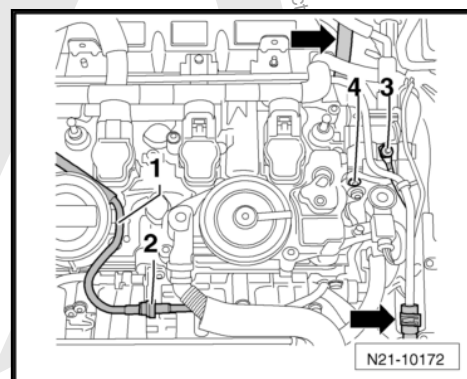
- Disconnect the connectors in direction of -arrows- from the Ignition Coils with Output Stages and lay the wiring harness to the side.



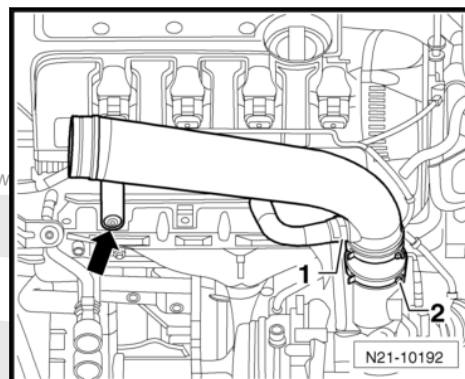
- Disconnect the coolant hose leading to the coolant reservoir -arrow-.



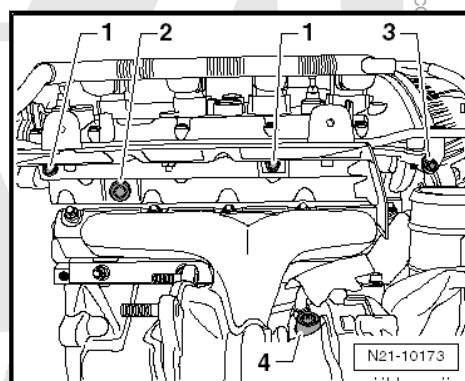
- Disconnect the vacuum line -1- at the separating point -2- and free up the wire.



- Remove the coolant hoses -arrows- from the coolant pipe.
- Disconnect the Ground (GND) wire -3- and remove the bolt -4-.
- Remove the air guide pipe bolt -arrow-.

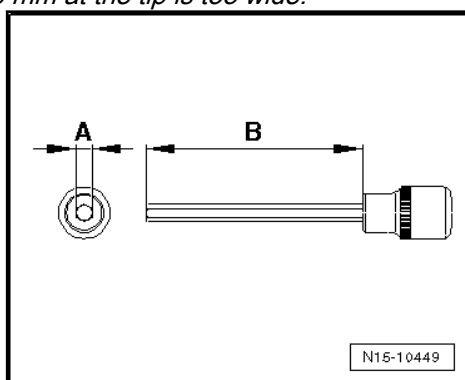


- Loosen the hose clamp -2- and lay the air duct pipe on the cylinder head.
- Seal the turbocharger with the Engine Bung Set -VAS6122-.
- Remove the bolts -1 through 3- and remove the heat shield together with the coolant pipe.



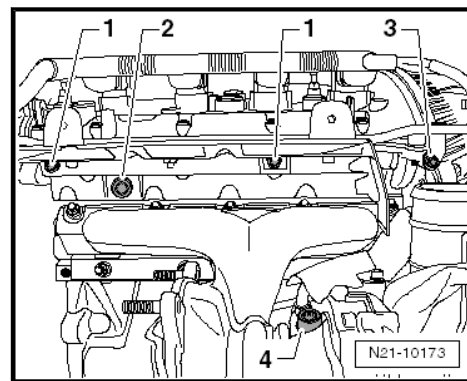
#### Note

Remove the bolt -2- from the heat shield using a 6 mm hex fitting socket -A-. The hex socket must be at least 5 cm -B- long. A socket that tapers to 6 mm at the tip is too wide.

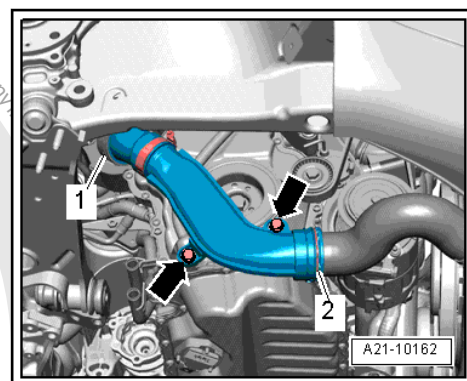


- Disconnect the oil supply line from the turbocharger -4-.

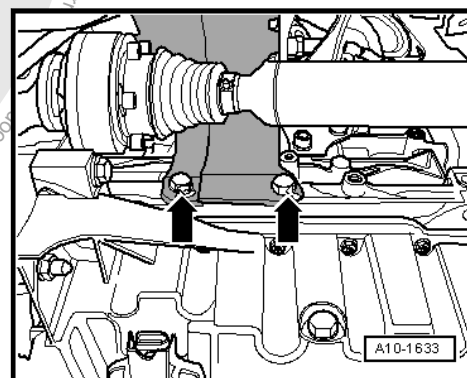




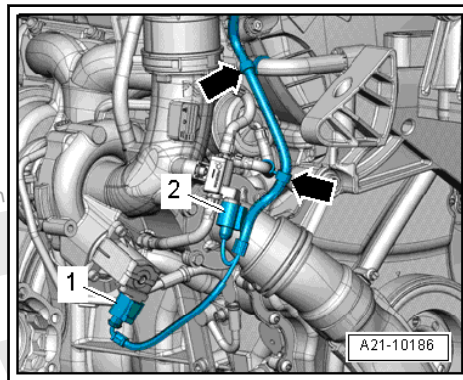
- Remove the bolts -arrows-.



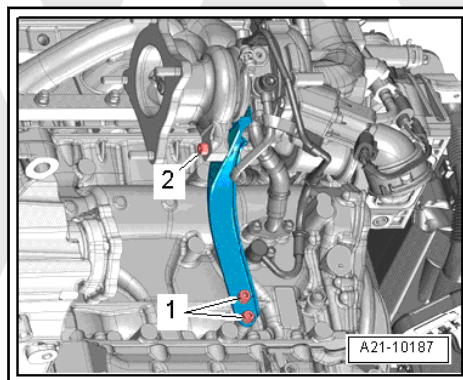
- Open the clamps -1 and 2- and remove the air guide pipe.
- Remove the right drive axle heat shield -arrows-.



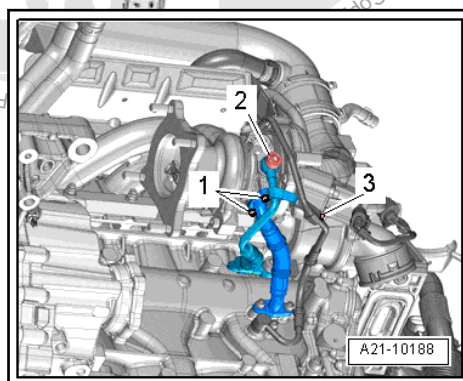
- Remove the front exhaust pipe with catalytic converter. Refer to ➔ [E3.2 exhaust Pipe](#), page 444 .
- Disconnect the connectors -1 and 2- and free up the wire -arrows-.



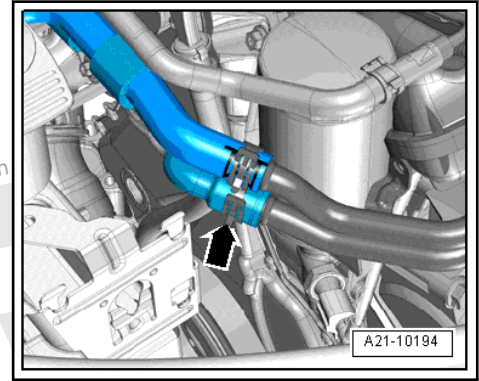
- Remove the bolt -1- using the Socket -Xzn 10-T10154-.



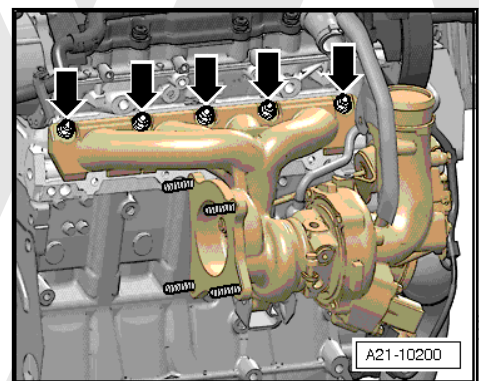
- Remove the bolt -2-.
- Remove the banjo bolt -2- and move the coolant line to the side.



- Remove the bolts -1- on the oil return line.
- Remove the bolt -3- on the oil supply line.
- Disconnect the coolant hose -arrow- and move it to the side.



- Remove the nuts -arrows-.
- Remove the turbocharger/exhaust manifold upward.



## Installing



### Caution

*If mechanical damage is found on the turbocharger, for example a destroyed compression wheel, it is not enough to just replace the turbocharger. Perform the following steps to prevent subsequent damage.*

- ◆ *Clean all oil lines.*
- ◆ *Change the engine oil and the oil filter.*
- ◆ *Check the air filter housing, the air filter element and the intake hoses for contamination.*
- ◆ *Check entire charge air circuit and charge air cooler for foreign objects.*

*If foreign objects are found in charge air circuit, the circuit must be cleaned and the cooler replaced if necessary.*

*The oil supply pipe must be replaced when installing a new turbocharger.*

- ◆ Tightening specifications. Refer to ➤ [-1.3 Turbocharger-](#), [page 350](#).

Install in reverse order of removal. Note the following:

- ◆ Hose connections and charge air system hoses must be free of oil and grease before installing. Only on connector couplings, the gasket and sealing surfaces must be lightly oiled. Refer to ➤ [C1.1 onnections with Connector Couplings, Assembling](#)”, [page 348](#).



- ◆ Install only approved clamps for securing hose connections. Refer to the Parts Catalog.
- ◆ Assembly of hose connections with connection couplings. Refer to ➤ [C1.1 onnections with Connector Couplings, Assembling", page 348](#) .
- ◆ Always replace seals, gaskets and self-locking nuts.
- ◆ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.
- ◆ Fill the turbocharger with engine oil at the connection for oil supply line.
- ◆ After installing turbocharger, let engine idle for approximately one minute without increasing engine speed. This ensures adequate oil supply to the turbocharger.
- ◆ Coolant return line -Item 5- ➤ [Item 5 \(page 355\)](#) must be installed together with turbocharger.
- Observe the notes after connecting the Battery -A-. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Removal and Installation.
- Install the air ducts with connector coupling. Refer to ➤ [C1.1 onnections with Connector Couplings, Assembling", page 348](#) .
- Check the coolant level. Refer to ➤ [D1.1 raining and Filling", page 229](#) .

### 3.3 Turbocharger Vacuum Diaphragm, Replacing

#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-



#### Note

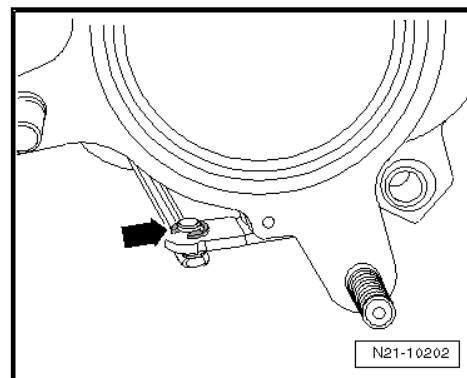
- ◆ *Hose connections and charge air system hoses must be free of oil and grease before installing. Only on connector couplings, the gasket and sealing surfaces must be lightly oiled. Refer to ➤ [C1.1 onnections with Connector Couplings, Assembling", page 348](#) .*
- ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*
- ◆ *The charge air system must be properly sealed.*
- ◆ *Replace the self-locking nuts.*
- ◆ *Use Spring-Type Clip Pliers to installing spring clips.*
- ◆ *Assembly of hose connections with connection couplings. Refer to ➤ [C1.1 onnections with Connector Couplings, Assembling", page 348](#) .*
- ◆ *Fill the turbocharger with engine oil at the connection for oil supply line.*
- ◆ *After installing turbocharger, let engine idle for approximately one minute without increasing engine speed. This ensures adequate oil supply to the turbocharger.*

#### Removing

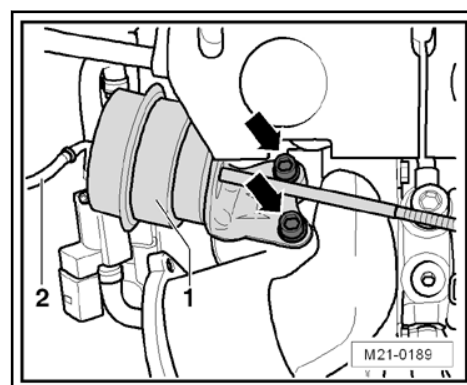
- Remove the turbocharger. Refer to ➤ [3.2 , page 367](#) .



- Remove the circlip -arrow- from the vacuum diaphragm linkage.



- Disconnect the vacuum line -2- on the vacuum diaphragm -1-.
- Remove the vacuum diaphragm -1- from the turbocharger -arrows-.



### Installing

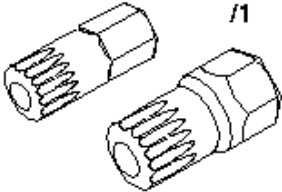
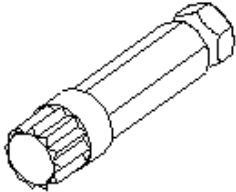

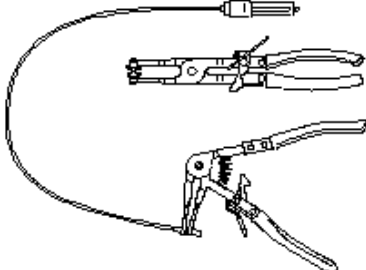

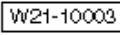
Install in reverse order of removal.

- ◆ Tightening specification. Refer to [⇒ r1.3.4 replacePart IV, page 356](#).



## 4 Special Tools

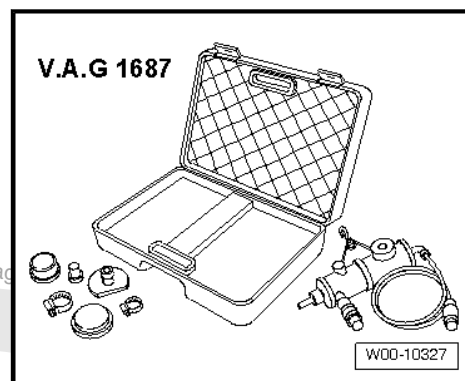
Special tools and workshop equipment required

<b>T10099</b> 	<b>T10154</b> 
<b>V.A.G 1331</b> 	<b>VAS 5024 A</b> 
<b>VAS 6122</b> 	

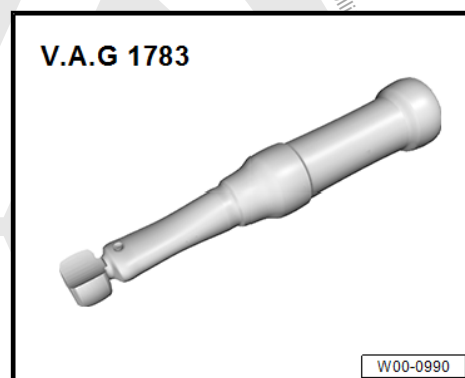
- ◆ Bits for VAG1331/13 -T10099-
- ◆ Socket - Xzn 10 -T10154-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Spring Clip Pliers
- ◆ Engine Bung Set -VAS6122-
- ◆ Hot Bolt Paste. Refer to the Parts Catalog.



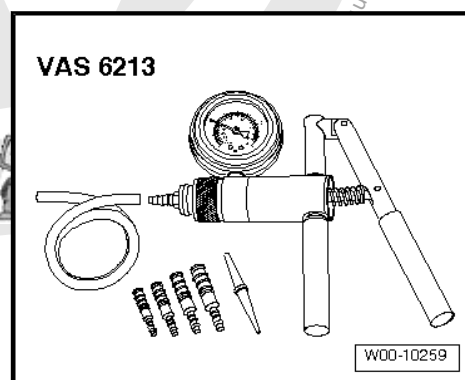
- ◆ Turbo System Tester Kit - VAG1687- with Turbo System  
Tester Kit - Adapter 5 -VAG1687/5-



- ◆ Ultrasonic Tester - VAG1842- or commercially available leak  
detection spray
- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-



- ◆ Hand Vacuum Pump -VAS6213-



- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-





## 24 – Multiport Fuel Injection

### 1 General Information

⇒ [11.1 injectors, Cleaning", page 378](#)

⇒ [V1.2 alve Control Module, Cleaning", page 379](#)

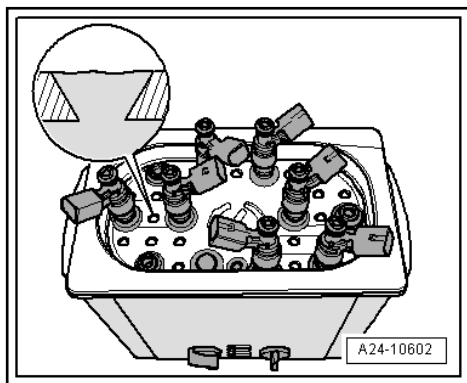
#### 1.1 Fuel Injectors, Cleaning

##### Special tools and workshop equipment required

- ◆ Ultrasonic Cleaning Unit -VAS6418-
- ◆ Ultrasonic Cleaning Unit - Mounting Plate for Injection Modules -VAS6418/1-
- ◆ Ultrasonic Cleaning Unit - Cleaning Fluid -VAS6418/2-

##### Conditions

- The Ultrasonic Cleaning Unit must be filled to the upper edge of the holes with Cleaning Fluid -VAS6418/2-magnified area-.

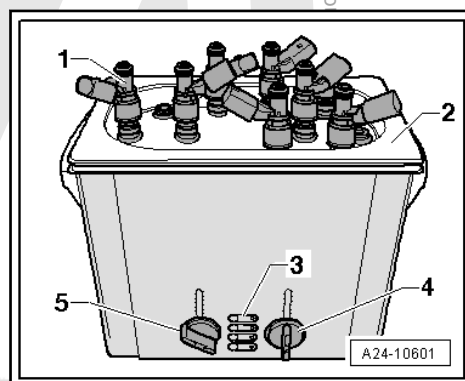


##### Note

Follow the safety precautions and the instructions for the Ultrasonic cleaning unit. Refer to Operating Instructions.

##### Procedure

- Remove the Fuel Injectors. Refer to [⇒ 14.4 injectors", page 410](#).
- Insert the Fuel Injectors -1- all the way into the Mounting Plate for Injection Modules -VAS6418/1- -2-.





- Dip the Fuel Injectors with the Mounting Plate for Injection Modules -VAS6418/1- into the Cleaning Fluid -VAS6418/2-.
- Adjust the temperature to 50 degrees using the knob -4-.
- Set a cleaning time of 30 minutes using the knob -5-.
- Switch the ultrasonic device on with the button -3-.



#### Note

*The time begins counting down once the cleaning temperature reaches 50 degrees.*

- Always replace the combustion chamber seal (Teflon® seal) for each Fuel Injector after cleaning. Refer to [⇒ I4.5 njector Seals, Replacing", page 414](#) .
- Then install the Fuel Injectors. Refer to [⇒ I4.4 njectors", page 410](#) .

## 1.2 Throttle Valve Control Module, Cleaning

### Special tools and workshop equipment required

- ◆ Acetone

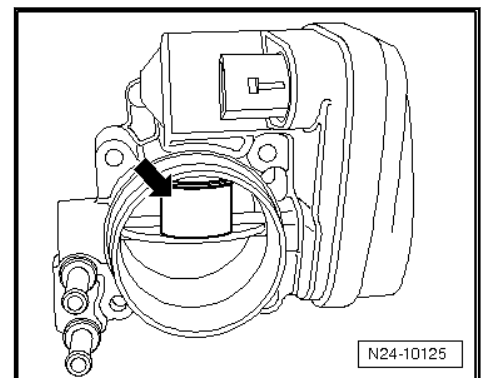


#### Note

- ◆ *If a new Engine Control Module is installed, then it must be adapted to the Throttle Valve Control Module. The adaptation may only be performed on a new or cleaned Throttle Valve Control Module because dirt/coke on the end position of the throttle can result in incorrect adaptation values.*
- ◆ *The throttle valve connections must not be scratched when cleaning.*

### Procedure

- Follow all the guidelines for clean working conditions. Refer to [⇒ f1.1 or Clean Working Conditions", page 1](#) .
- Remove the Throttle Valve Control Module. Refer to [⇒ T4.10 hrottle Valve Control Module J338 ", page 430](#) .
- Open throttle valve by hand and hold it in open position with a suitable object (for example, a plastic or wood wedge)  
-arrow-.



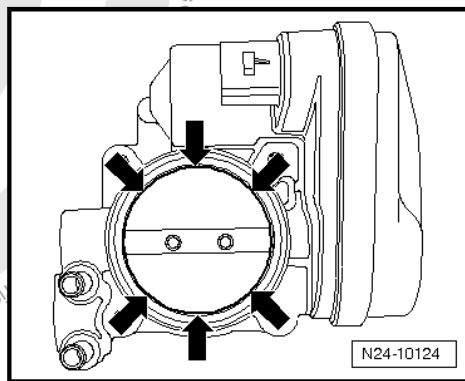


#### WARNING

**Acetone is easily flammable.**

- ◆ **Observe accident prevention measures and the safety precautions when working with easily flammable fluids.**
- ◆ **Do not use compressed air when cleaning throttle valve.**
- ◆ **Always wear protective eyewear and protective clothing to prevent injuries and contact with skin.**

- Clean throttle valve connections, especially in area of closed throttle valve, with standard acetone and a brush.



- Wipe throttle valve connections with a lint-free cloth.
- Allow the acetone to dry completely and reinstall the cleaned Throttle Valve Control Module. Refer to ➤ [T4.10 Throttle Valve Control Module J338](#), page 430.
- Adapt the Engine Control Module to the Throttle Valve Control Module -J338- using the Vehicle Diagnostic Tester. Refer to Vehicle Diagnostic Tester "Guided Functions".



## 2 Description and Operation

⇒ [L2.1 ocation Overview - Fuel Injection System", page 381](#)

⇒ [-2.2 Air Filter Housing", page 387](#)

⇒ [-2.3 Fuel Pipe and Fuel Rail", page 389](#)

⇒ [O2.4 erview - High Pressure Pump", page 391](#)

⇒ [-2.5 Intake Manifold", page 393](#)

### 2.1 Component Location Overview - Fuel Injection System



#### Note

*Components A through F are not shown in the illustration.*





#### A - Data Link Connector (DLC)

- ☐ In the driver side footwell

#### B - Mass Airflow Sensor - G70-

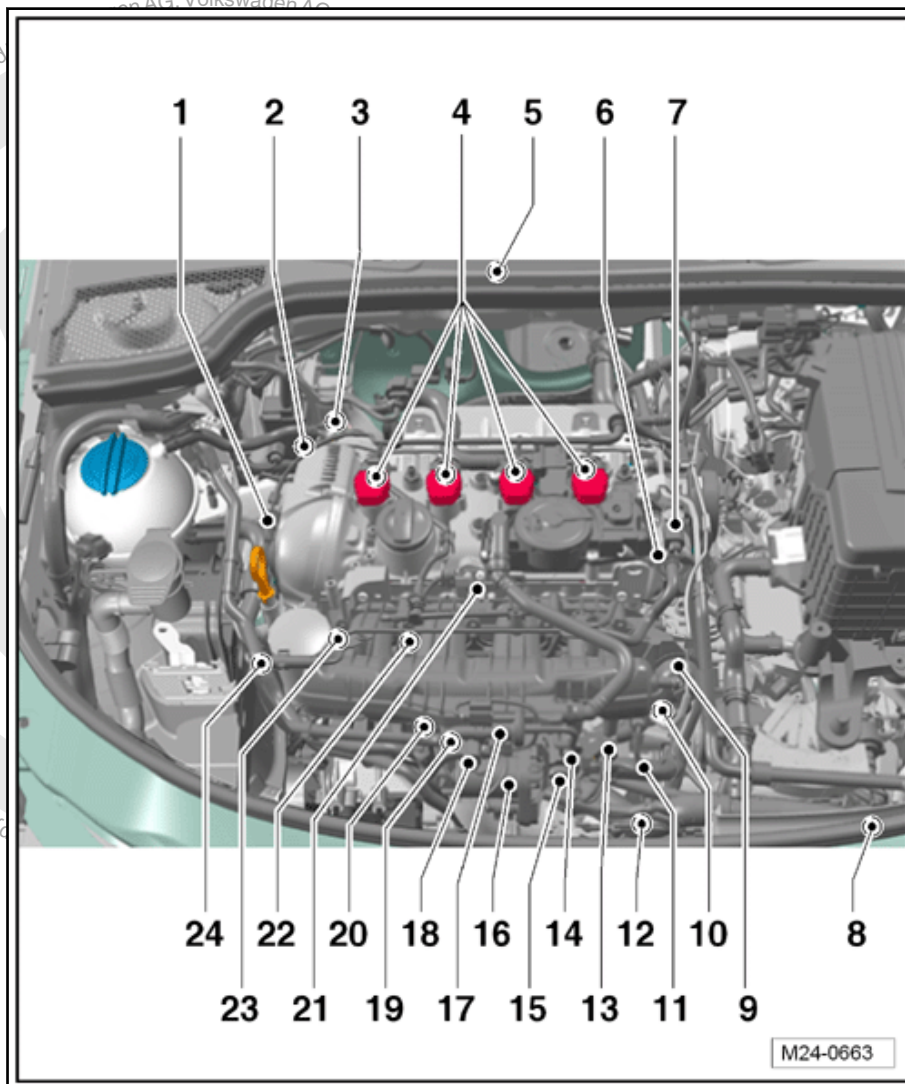
- ☐ With Intake Air Temperature Sensor 2 -G299-
- ☐ Component location. Refer to ➤ [Fig. "Mass Airflow Sensor -G70-1- ", page 384](#) .
- ☐ Removing and installing. Refer to ➤ [M4.9. Mass Airflow Sensor G70 ", page 429](#) .

#### C - Accelerator Pedal Position Sensor -G79- and Accelerator Pedal Position Sensor 2 -G185-

- ☐ On the accelerator pedal (both sensors are integrated into one housing)
- ☐ Overview - accelerator pedal module. Refer to ➤ [-2.2 Accelerator Pedal Module", page 283](#) .

#### D - Coolant Fan Control Module -J293-

- ☐ The Coolant Fan Control Module -J293- is integrated in the Coolant Fan -V7-.



#### E - Fuel Injectors

- ☐ Cylinder 1 Fuel Injector -N30-
- ☐ Cylinder 2 Fuel Injector -N31-
- ☐ Cylinder 3 Fuel Injector -N32-
- ☐ Cylinder 4 Fuel Injector -N33-
- ☐ In the fuel rail. Refer to ➤ [-2.3 Fuel Pipe and Fuel Rail", page 389](#)
- ☐ Removing and installing. Refer to ➤ [14.4 injectors", page 410](#) .
- ☐ Cleaning. Refer to ➤ [V1.2 Valve Control Module, Cleaning", page 379](#) .

#### F - Evaporative Emission (EVAP) System

- ☐ Overview. Refer to ➤ [-2.3 EVAP System", page 283](#) .

#### 1 - Camshaft Adjustment Valve 1 -N205-

- ☐ Removing and installing. Refer to ➤ [C3.3 Camshaft Adjustment Valve 1 N205 ", page 127](#) .

#### 2 - Wastegate Bypass Regulator Valve -N75-

- ☐ Installed directly on turbocharger. Refer to ➤ [Fig. "Turbocharger Components", page 386](#)

#### 3 - Turbocharger Recirculation Valve -N249-

- ☐ Installed directly on turbocharger. Refer to ➤ [Fig. "Turbocharger Components", page 386](#)

#### 4 - Ignition Coils with Power Output Stages

- ☐ Ignition Coil 1 with Power Output Stage -N70-
- ☐ Ignition Coil 2 with Power Output Stage -N127-
- ☐ Ignition Coil 3 with Power Output Stage -N291-



- ☐ Ignition Coil 4 with Power Output Stage -N292-
- ☐ Removing and installing. Refer to [⇒ C4.2 oils with Power Output Stages", page 459](#) .
- 5 - Engine Control Module -J623-**
  - ☐ Removing and installing. Refer to [⇒ E4.3 ngine Control Module J623, Removing and Installing", page 406](#) .
- 6 - High Pressure Pump**
  - ☐ With Fuel Pressure Regulator Valve -N276-
  - ☐ Component Location:
  - ◆ Refer to [⇒ Fig. ""High Pressure Pump""", page 384](#)
  - ☐ Removing and installing. Refer to [⇒ P4.7 ressure Pump", page 418](#) .
- 7 - Fuel Pressure Regulator Valve -N276-**
  - ☐ Component location. Refer to [⇒ Fig. ""High Pressure Pump""", page 384](#) .
- 8 - Engine Coolant Temperature Sensor on Radiator Outlet -G83-**
  - ☐ In the lower radiator connection. Refer to [⇒ -2.5 Radiator/Coolant Fan", page 240](#)
- 9 - Vacuum Actuator**
  - ☐ For variable intake manifold
  - ☐ Component location. Refer to [⇒ Fig. "" Intake Manifold Runner Control Valve -N316- -2- """, page 384](#) .
- 10 - Intake Manifold Runner Control Valve -N316-**
  - ☐ Component location. Refer to [⇒ Fig. "" Intake Manifold Runner Control Valve -N316- -2- """, page 384](#) .
- 11 - Engine Speed Sensor -G28-**
  - ☐ On the front lower left side of the cylinder block, next to the oil separator. Refer to [⇒ Fig. "" Engine Speed Sensor -G28- -1- """, page 385](#)
  - ☐ Removing and installing. Refer to [⇒ E4.1 ngine Speed Sensor G28 ", page 458](#) .
- 12 - Charge Air Pressure Sensor -G31-**
  - ☐ Component location. Refer to [⇒ Fig. "" Charge Air Pressure Sensor -G31- -1- """, page 386](#) .
- 13 - Knock Sensor 1 -G61- Connector**
  - ☐ Installed location beneath intake manifold. Refer to [⇒ Fig. ""Connectors""", page 385](#)
- 14 - Camshaft Position Sensor -G40- Connector**
  - ☐ Installed location beneath intake manifold. Refer to [⇒ Fig. ""Connectors""", page 385](#)
- 15 - 8-Pin Connector for Fuel Injectors**
  - ☐ Installed location beneath intake manifold. Refer to [⇒ Fig. ""Connectors""", page 385](#)
- 16 - Throttle Valve Control Module -J338-**
  - ☐ With EPC Throttle Drive -G186-, EPC Throttle Drive Angle Sensor 1 -G187- and EPC Throttle Drive Angle Sensor 2 -G188-
  - ☐ Removing and installing. Refer to [⇒ T4.10 hrottle Valve Control Module J338 ", page 430](#) .
  - ☐ Cleaning. Refer to [⇒ V1.2 alve Control Module, Cleaning", page 379](#) .
- 17 - EVAP Canister Purge Regulator Valve 1 -N80-**
  - ☐ Overview - installed location. Refer to [⇒ -2.5 Intake Manifold", page 393](#) , Intake Manifold
- 18 - Intake Air Temperature Sensor -G42-**
  - ☐ Overview - installed location. Refer to [⇒ -2.5 Intake Manifold", page 393](#) , Intake Manifold
- 19 - Knock Sensor 1 -G61-**
  - ☐ On the front cylinder head under the intake manifold. Refer to [⇒ -2.1 Ignition System", page 454](#)
  - ☐ Removing and installing. Refer to [⇒ K4.3 nock Sensor 1 G61 ", page 460](#) .
- 20 - Engine Coolant Temperature Sensor -G62-**
  - ☐ Inside the coolant pump housing. Refer to [⇒ Fig. "" Engine Coolant Temperature Sensor -G62- -1- """, page 386](#)
- 21 - Camshaft Position Sensor -G40-**





- ❑ Bolted on the front cylinder head cover. Refer to ➤ [Fig. "Camshaft Position Sensor -G40- -1- ", page 385](#)

## 22 - Fuel Pressure Sensor -G247-

- ❑ On the fuel rail. Refer to ➤ [-2.3 Fuel Pipe and Fuel Rail", page 389](#) , Overview - Fuel Rail

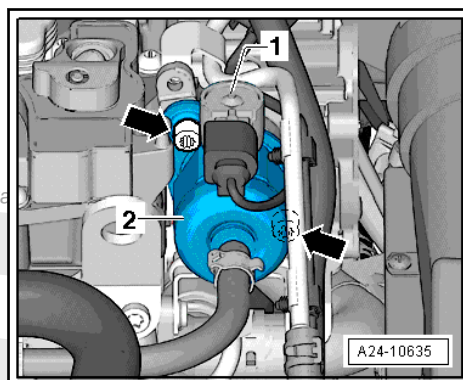
## 23 - Intake Manifold Runner Position Sensor -G336-

- ❑ In the right intake manifold. Refer to ➤ [-2.3 Fuel Pipe and Fuel Rail", page 389](#)
- ❑ To remove and install, remove intake manifold. Refer to ➤ [M4.8 anifold with Fuel Rail", page 421](#) .

## 24 - Oil Pressure Switch -F1-

- ❑ Inside the sub-assembly bracket
- ◆ Overview. Refer to ➤ [-2.2 Oil Filter Housing/Oil Pressure SwitchF1 ", page 201](#)

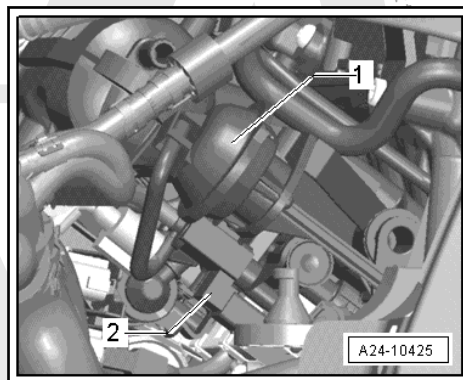
## High Pressure Pump



1 - Fuel Pressure Regulator Valve -N276-

2 - Fuel high pressure pump

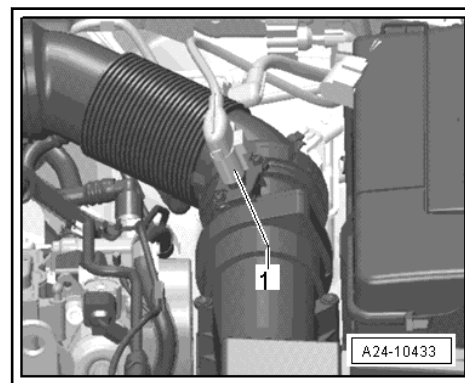
## Intake Manifold Runner Control Valve -N316- -2-



1 - Vacuum actuator for variable intake manifold

## Mass Airflow Sensor -G70- -1-





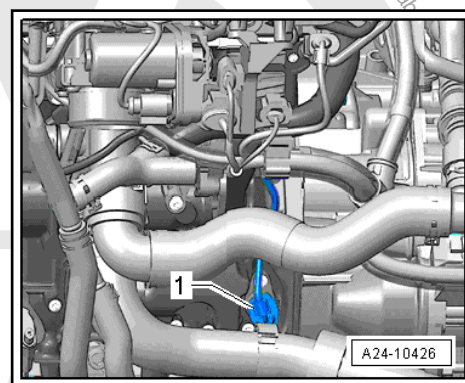
- ◆ With Intake Air Temperature Sensor 2 -G299-



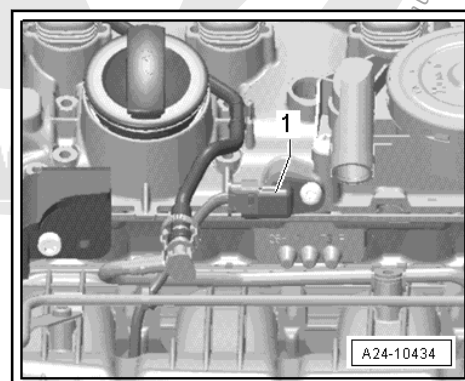
#### Note

*The Intake Air Temperature Sensor 2 -G299- and the Mass Airflow Sensor -G70- are integrated in one housing.*

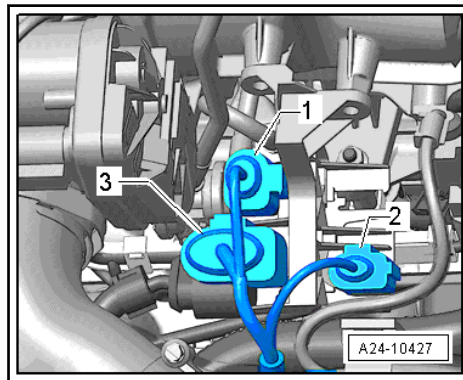
#### Engine Speed Sensor -G28- -1-



#### Camshaft Position Sensor -G40- -1-

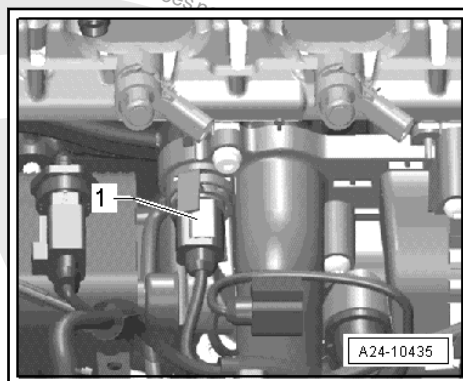


#### Connectors



- 1 - From Camshaft Position Sensor -G40-
- 2 - From Knock Sensor 1 -G61-
- 3 - 8-Pin Connector for Fuel Injectors

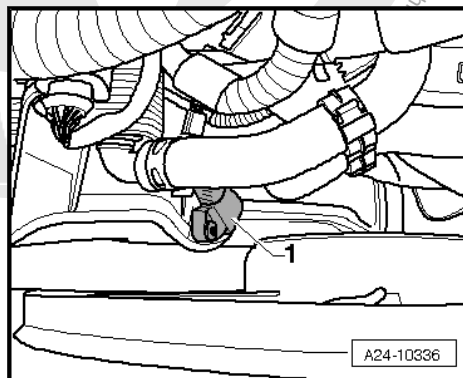
#### Engine Coolant Temperature Sensor -G62- -1-



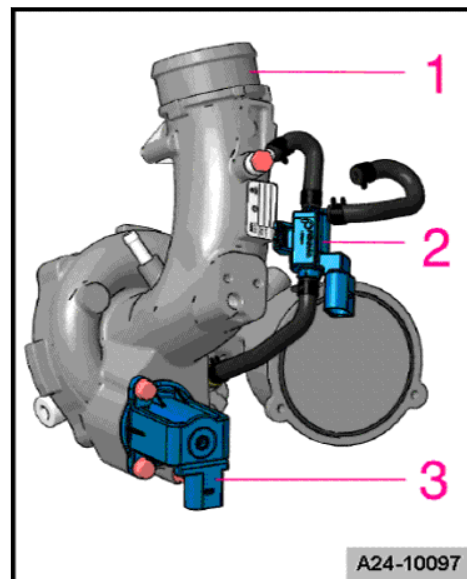
#### Note

*Under the intake manifold (the intake manifold is not shown in the illustration).*

#### Charge Air Pressure Sensor -G31- -1-



#### Turbocharger Components



- 1 - Turbocharger
- 2 - Wastegate Bypass Regulator Valve -N75-
- 3 - Turbocharger Recirculation Valve -N249-



#### Note

Overview - Turbocharger, Part I. Refer to [⇒ 11.3.1", page 351](#).

## 2.2 Overview - Air Filter Housing



#### Note

Air filter, removing and installing. Refer to [⇒ F4.2 ilter Housing", page 404](#).



**1 - Spring Clamp**

**2 - Air Guide Hose**

- ☐ To turbocharger
- ☐ Make sure it is secure
- ☐ Check for dirt

**3 - Mass Airflow Sensor -G70-**

- ☐ With Intake Air Temperature Sensor 2 -G299-
- ☐ Removing and installing. Refer to ➤ [M4.9 ass Airflow Sensor G70", page 429](#) .
- ☐ Bolted to the air filter upper section (3.5 Nm)

**4 - O-Ring**

- ☐ Always replace

**5 - Screws**

- ☐ 1.5 Nm
- ☐ For the air filter housing upper section

**6 - Screws**

- ☐ 1.5 Nm
- ☐ For the air filter housing upper section

**7 - Air Filter Upper Section**

- ☐ Clean the upper section of the air filter from salt, dirt and leaves.

**8 - Secondary Air Guide**

Only on engine code CBFA:

- ☐ Make sure it is secure
- ☐ To the Secondary Air Injection Pump Motor -V101-

**9 - Filter Element**

- ☐ Always use original air filter insert. Refer to the Parts Catalog
- ☐ Note the replacement intervals. Refer to ➤ Maintenance; Booklet 20.1 .
- ☐ Removing and installing. Refer to ➤ [F4.1 ilter Element", page 402](#) .

**10 - Snow Screen**

- ☐ Not installed on all vehicles

**11 - Air Filter Lower Section**

- ☐ Clean the lower section of the air filter from salt, dirt and leaves.

**12 - Water Drain Hose Connection**

- ☐ Clean the connection

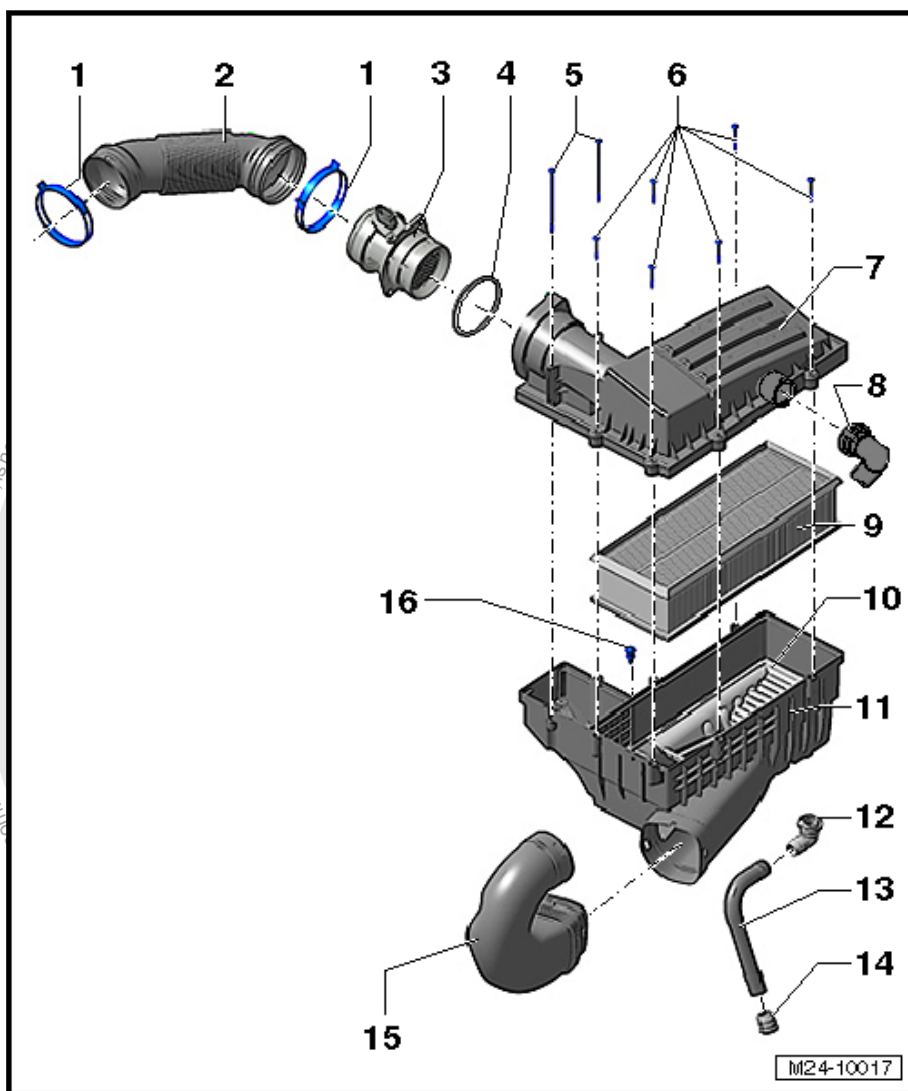
**13 - Water Drain Hose**

- ☐ Clean the water drain hose

**14 - Shutter Valve**

**15 - Intake Air Duct**

- ☐ From the air duct on the lock carrier
- ☐ Clean dirt and leaves from intake air guide





#### 16 - Bolt

- ☐ 8 Nm
- ☐ For the air filter lower section

## 2.3 Overview - Fuel Pipe and Fuel Rail



### WARNING

***The fuel system is under pressure!***

- ◆ ***Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to ⇒ P1.2 recautions, page 2.***

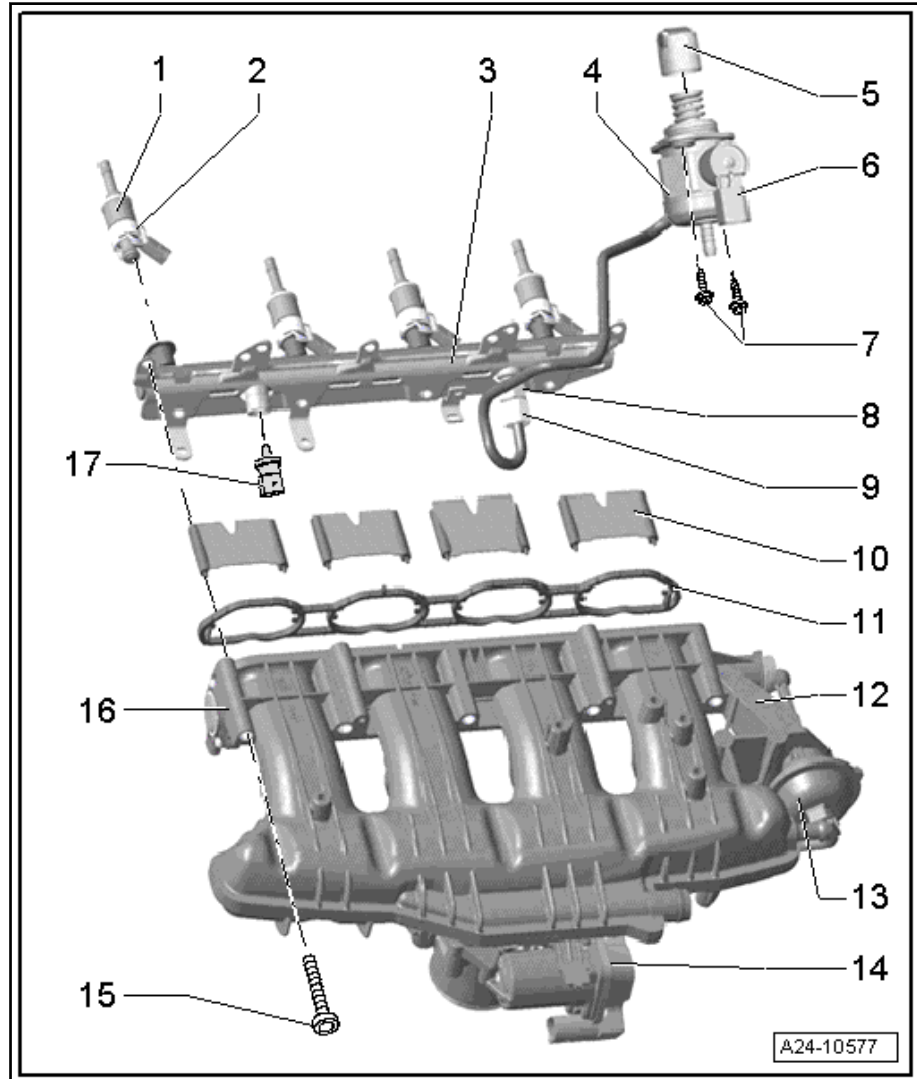
**1 - Fuel Injector**

- ☐ Cylinder 1 Fuel Injector -N30-
- ☐ Cylinder 2 Fuel Injector -N31-
- ☐ Cylinder 3 Fuel Injector -N32-
- ☐ Cylinder 4 Fuel Injector -N33-
- ☐ With combustion chamber seal (Teflon seal), always replace. Refer to ⇒ I4.5 injectors Seals, Replacing, page 414 .
- ☐ Replace the O-rings.
- ☐ Make sure it is installed in the correct position.
- ☐ Removing and installing. Refer to ⇒ I4.4 injectors, page 410 .
- ☐ Cleaning. Refer to ⇒ I1.1 injectors, Cleaning, page 378 .

## 2 - Support Ring

### 3 - Fuel Rail

- ❑ Removing and installing. Refer to ➞ M4.8 anifold with Fuel Rail, page 421 .
- ❑ Fuel rail, separating from the intake manifold. Refer to ➞ page 428



#### 4 - High Pressure Pump

- ❑ There is an electrical Fuel Pump located in the fuel tank, which supplies fuel to the mechanical high pressure pump at a pressure of approximately 7 bar (101.52 psi)
- ❑ When installing the high-pressure pump, make sure that no dirt enters the fuel system.
- ❑ The fuel system must be pressureless to install the high-pressure pump, releasing fuel pressure. Refer to [⇒ P1.2 recautions", page 2](#)
- ❑ Install the fuel line to the fuel rail free from tension
- ❑ Overview - high pressure pump with Fuel Pressure Regulator Valve -N276-. Refer to [⇒ O2.4 verview - High Pressure Pump", page 391](#) .
- ❑ Removing and installing. Refer to [⇒ P4.7 ressure Pump", page 418](#) .

## 5 - Roller Tappet

- ☐ Remains inserted in cylinder head after removing the high-pressure pump, removable

## 6 - Fuel Pressure Regulator Valve -N276-

- ❑ Overview - high pressure pump with Fuel Pressure Regulator Valve -N276-. Refer to [⇒ O2.4 overview - High Pressure Pump](#), page 391 .

## 7 - High Pressure Pump Bolts

- ❑ M6 thread: 8 Nm + 90° (1/4 turn) additional turn. Replacing the bolts.
- ❑ M8 thread: 20 Nm

## 8 - Connection

- ☐ 22 Nm
- ☐ Always replace





- ☐ For the high pressure fuel line
- Always check the connection tightening specification before installing the high pressure fuel line.

#### 9 - High Pressure Fuel Line

- ☐ Union nut: 18 Nm
- First tighten the high pressure fuel line union nut by hand. Align so it is free of stress.

#### 10 - Intake Manifold Flaps

##### 11 - Seal

- ☐ Always replace

##### 12 - Intake Manifold

- ☐ Removing and installing. Refer to [⇒ M4.8 anifold with Fuel Rail", page 421](#) .

##### 13 - Vacuum Actuator

- ☐ For variable intake manifold
- ☐ Checking, (refer to [⇒ I3.2 ntake Manifold, Checking", page 399](#)

##### 14 - Throttle Valve Control Module -J338-

- ☐ With EPC Throttle Drive -G186-, EPC Throttle Drive Angle Sensor 1 -G187- and EPC Throttle Drive Angle Sensor 2 -G188-
- ☐ After replacing the Throttle Valve Control Module -J338-, it must be newly adapted to the Engine Control Module -J623- using the vehicle diagnostic tester. Refer to Vehicle Diagnostic Tester "Guided Functions".
- ☐ Removing and installing. Refer to [⇒ T4.10 hrottle Valve Control Module J338", page 430](#) .
- ☐ Cleaning. Refer to [⇒ V1.2 alve Control Module, Cleaning", page 379](#)

##### 15 - Intake Manifold Bolts

- ☐ Tighten to 3 Nm, and then tighten to 9 Nm

##### 16 - Intake Manifold Runner Position Sensor -G336-

- ☐ To remove and install, remove intake manifold. Refer to [⇒ M4.8 anifold with Fuel Rail", page 421](#) .

##### 17 - Fuel Pressure Sensor -G247-

- ☐ 27 Nm
- ☐ Coat the threads with clean engine oil.
- ☐ Checking. Refer to [⇒ F3.1 uel Pressure Sensor G247, Checking", page 396](#) .
- ☐ Removing and installing. Refer to [⇒ F4.6 uel Pressure Sensor G247", page 417](#) .

## 2.4 Guided Overview - High Pressure Pump



### WARNING

***The fuel system is under pressure!***

- ◆ ***Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to [⇒ P1.2 recautions", page 2](#) .***







### 1 - Roller Tappet

- ❑ Remains inserted in cylinder head after removing the high-pressure pump, removable

### 2 - O-Ring

- ❑ Always replace

### 3 - High Pressure Pump

- ❑ There is an electrical Fuel Pump located in the fuel tank, which supplies fuel to the mechanical high pressure pump at a pressure of approximately 7 bar (101.52 psi)
- ❑ When installing the high-pressure pump, make sure that no dirt enters the fuel system.
- ❑ The fuel system must be pressureless to install the high-pressure pump, releasing fuel pressure. Refer to [⇒ P1.2 recautions", page 2](#)
- ❑ Install the fuel line to the fuel rail free from tension
- ❑ Removing and installing. Refer to [⇒ P4.7 re-ssure Pump", page 418](#) .

### 4 - Fuel Pressure Regulator Valve -N276-

### 5 - Bore in the Cylinder Head

- ❑ For high pressure pump

### 6 - Fuel Injector

- ❑ Cylinder 1 Fuel Injector -N30-
- ❑ Cylinder 2 Fuel Injector -N31-
- ❑ Cylinder 3 Fuel Injector -N32-
- ❑ Cylinder 4 Fuel Injector -N33-
- ❑ With combustion chamber seal (Teflon® seal), always replace. Refer to [⇒ I4.5 njector Seals, Replacing", page 414](#) .
- ❑ Replace the O-rings.
- ❑ Make sure it is installed in the correct position.
- ❑ Removing and installing. Refer to [⇒ I4.4 njectors", page 410](#) .
- ❑ Cleaning. Refer to [⇒ I1.1 njectors, Cleaning", page 378](#) .

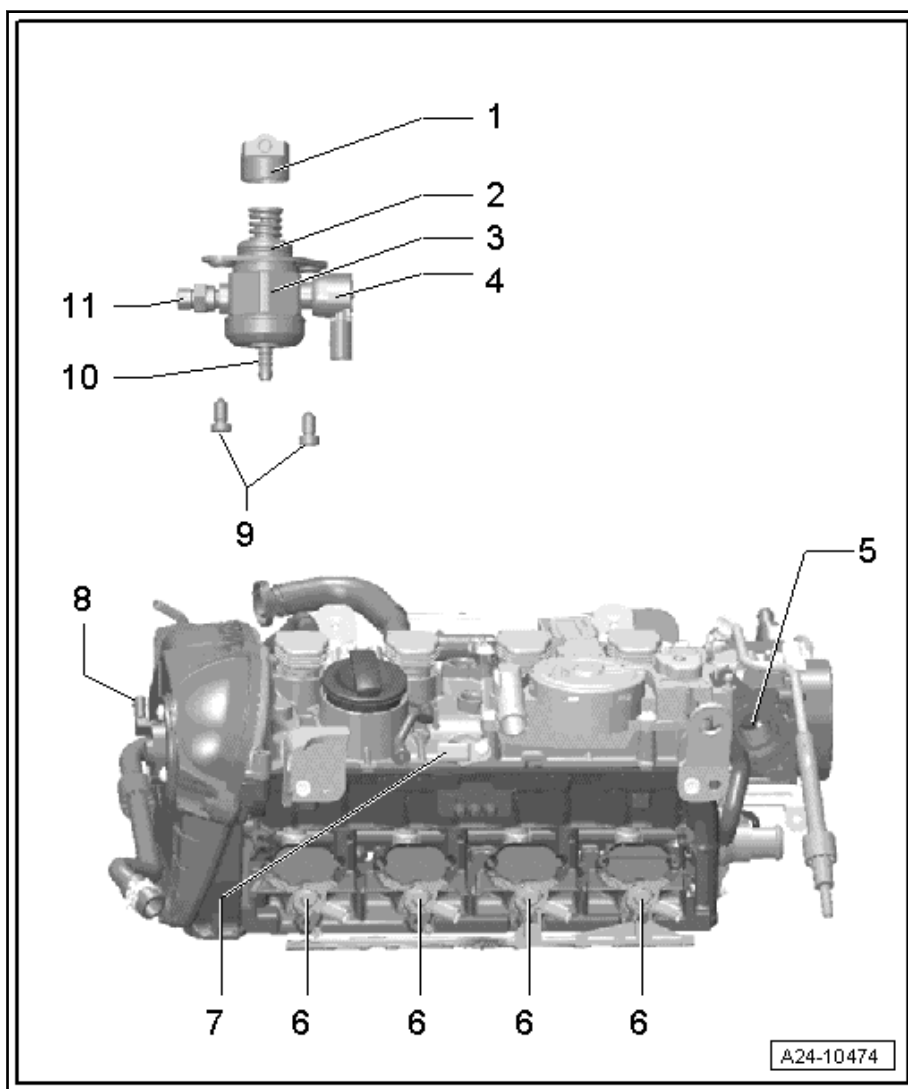
### 7 - Camshaft Position Sensor -G40-

- ❑ Bolted on the front cylinder head cover. Refer to [⇒ Fig. "" Camshaft Position Sensor -G40- -1- """, page 456](#)

### 8 - Camshaft Adjustment Valve 1 -N205-

- ❑ Removing and installing. Refer to [⇒ C3.3 amshaft Adjustment Valve 1 N205 ", page 127](#) .

### 9 - High Pressure Pump Bolts





- ☐ M6 thread: 8 Nm + 90° (1/4 turn) additional turn. Replacing the bolts.
- ☐ M8 thread: 20 Nm

#### 10 - Connection

- ☐ For the fuel supply line
- ☐ From the fuel tank

#### 11 - Connection

- ☐ 22 Nm
- ☐ Always replace
- ☐ For the high pressure fuel line to the fuel rail

## 2.5 Overview - Intake Manifold



### WARNING

***The fuel system is under pressure!***

- ◆ ***Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to ⇒ P1.2 recautions", page 2 .***



#### 1 - Bolt

- ☐ 5 Nm
- ☐ For Intake Air Temperature Sensor -G42-

#### 2 - Intake Air Temperature Sensor -G42-

#### 3 - EVAP Canister Purge Regulator Valve 1 -N80-

- ☐ With double check-valve -Item 15- ⇒ [Item 15 \(page 395\)](#), a single component
- ☐ To remove and install, remove intake manifold. Refer to ⇒ [M4.8 anifold with Fuel Rail", page 421](#).

#### 4 - Intake Manifold

- ☐ Removing and installing. Refer to ⇒ [M4.8 anifold with Fuel Rail", page 421](#).
- ☐ Bolt tightening specification -Item 15- ⇒ [Item 15 \(page 391\)](#).
- ☐ Fuel rail, separating from the intake manifold. Refer to ⇒ [page 428](#)

#### 5 - Vacuum Actuator

- ☐ For variable intake manifold
- ☐ Checking. Refer to ⇒ [13.2 ntake Manifold, Checking", page 399](#)

#### 6 - High Pressure Pump Bolts

- ☐ M6 thread: 8 Nm + 90° (1/4 turn) additional turn. Replacing the bolts.
- ☐ M8 thread: 20 Nm

#### 7 - Connection

- ☐ For the fuel supply line from the fuel tank

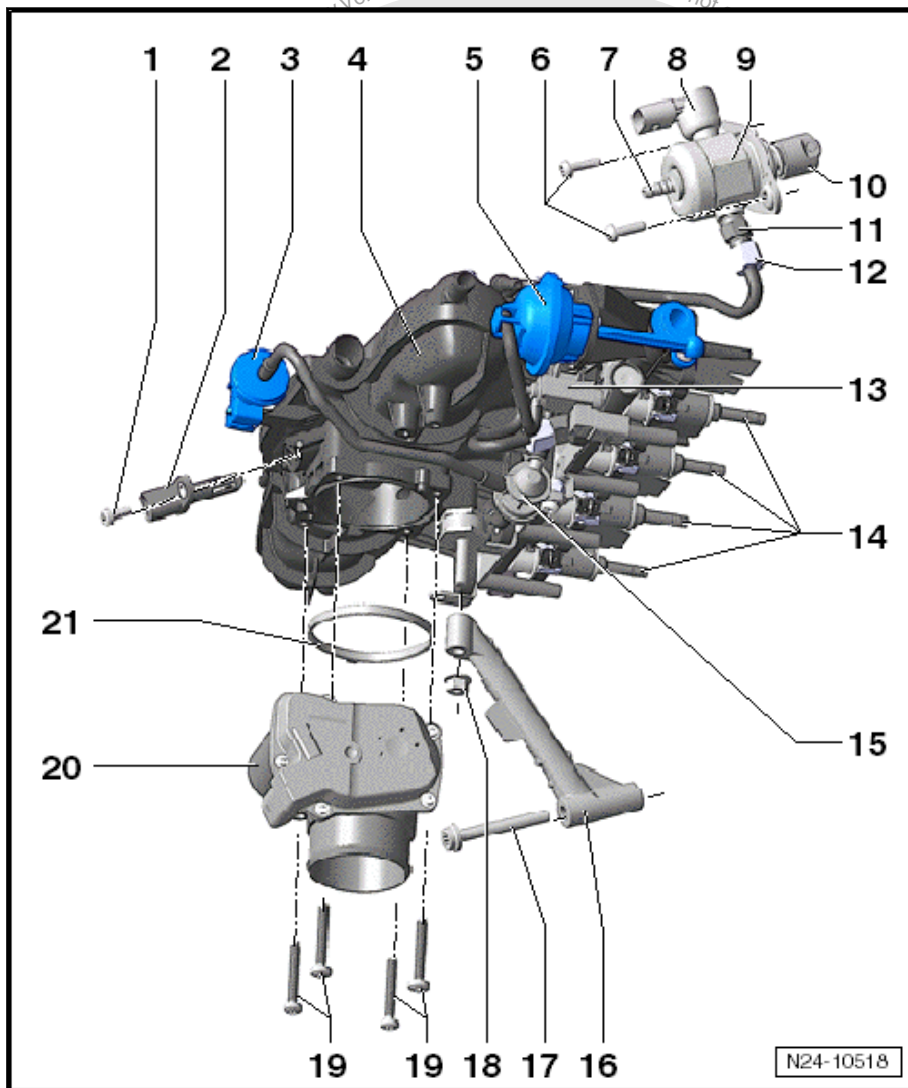
#### 8 - Fuel Pressure Regulator Valve -N276-

- ☐ Overview - High Pressure Pump with Fuel Pressure Regulator Valve -N276-. Refer to ⇒ [O2.4 verview - High Pressure Pump", page 391](#).

#### 9 - High Pressure Pump

- ☐ With Fuel Pressure Regulator Valve -N276-
- ☐ There is an electrical Fuel Pump located in the fuel tank, which supplies fuel to the mechanical high pressure pump at a pressure of approximately 7 bar (101.52 psi)
- ☐ When installing the high-pressure pump, make sure that no dirt enters the fuel system.
- ☐ The fuel system must be pressureless to install the high-pressure pump, releasing fuel pressure. Refer to ⇒ [P1.2 recautions", page 2](#)
- ☐ Install the fuel line to the fuel rail free from tension
- ☐ Overview - high pressure pump with Fuel Pressure Regulator Valve -N276-. Refer to ⇒ [O2.4 verview - High Pressure Pump", page 391](#).
- ☐ Removing and installing. Refer to ⇒ [P4.7 ressure Pump", page 418](#).

#### 10 - Roller Tappet





- ☐ Remains inserted in cylinder head after removing the high-pressure pump, removable

#### 11 - Connection

- ☐ 22 Nm
- ☐ Always replace
- ☐ For the high pressure fuel line
- Always check the connection tightening specification before installing the high pressure fuel line.

#### 12 - High Pressure Fuel Line to the Fuel Rail

- ☐ Union nut: 18 Nm
- First tighten the high pressure fuel line union nut by hand. Align so it is free of stress.

#### 13 - Intake Manifold Runner Control Valve -N316-

##### 14 - Fuel Injectors

- ☐ Cylinder 1 Fuel Injector -N30-
- ☐ Cylinder 2 Fuel Injector -N31-
- ☐ Cylinder 3 Fuel Injector -N32-
- ☐ Cylinder 4 Fuel Injector -N33-
- ☐ With combustion chamber seal (Teflon® seal), always replace. Refer to [⇒ I4.5 njector Seals, Replacing", page 414](#) .
- ☐ Replace the O-rings.
- ☐ Make sure it is installed in the correct position.
- ☐ Removing and installing. Refer to [⇒ I4.4 njectors", page 410](#) .
- ☐ Cleaning. Refer to [⇒ V1.2 alve Control Module, Cleaning", page 379](#) .

##### 15 - Double Check Valve

- ☐ Checking. Refer to [⇒ C3.1 heck-Valve, Checking", page 294](#) .
- ☐ With EVAP Canister Purge Regulator Valve 1 -N80- -Item 3- [⇒ Item 3 \(page 394\)](#) , one unit

##### 16 - Intake Manifold Support

##### 17 - Bolt

- ☐ 23 Nm
- ☐ For the intake manifold support

##### 18 - Nut

- ☐ 10 Nm
- ☐ For the intake manifold support

##### 19 - Bolts

- ☐ 5 Nm
- ☐ For the Throttle Valve Control Module - J338-
- ☐ Quantity: 4

##### 20 - Throttle Valve Control Module -J338-

- ☐ With EPC Throttle Drive -G186-, EPC Throttle Drive Angle Sensor 1 -G187 and EPC Throttle Drive Angle Sensor 2 -G188-
- ☐ After replacing the Throttle Valve Control Module -J338-, it must be newly adapted to the Engine Control Module -J623-. Refer to Vehicle Diagnostic Tester "Guided Functions".
- ☐ Removing and installing. Refer to [⇒ T4.10 hrottle Valve Control Module J338 ", page 430](#) .
- ☐ Cleaning. Refer to [⇒ V1.2 alve Control Module, Cleaning", page 379](#) .

##### 21 - Gasket

- ☐ Always replace
- ☐ The rim of the seal must fit into the groove provided for it inside the intake manifold



## 3 Diagnosis and Testing

⇒ [F3.1 uel Pressure Sensor G247, Checking", page 396](#)

⇒ [I3.2 ntake Manifold, Checking", page 399](#)

### 3.1 Fuel Pressure Sensor -G247-, Check- ing

#### Special tools and workshop equipment required

- ◆ Elbow Assembly Tool -T10118-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Vehicle Diagnostic Tester
- ◆ Pressure Sensor Tester -VAS6394/1- with Pressure Sensor Tester - Adapter 2 -VAS6394/2-
- ◆ Double Hexagon Socket - 27mm -VAS5301/7-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 3 Pin -VAS5570-
- ◆ Vehicle Diagnostic Tester

#### Test Sequence



#### Note

Overview - fuel rail. Refer to ⇒ [-2.3 Fuel Pipe and Fuel Rail", page 389](#).

- Read the safety precautions before starting. Refer to ⇒ [P1.2 recautions", page 2](#)
- Follow all the guidelines for clean working conditions. Refer to ⇒ [f1.1 or Clean Working Conditions", page 1](#).

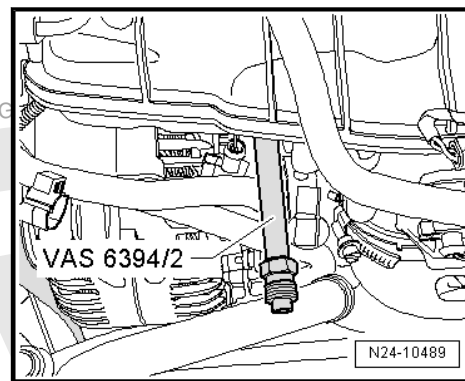


#### WARNING

***The fuel system is under pressure!***

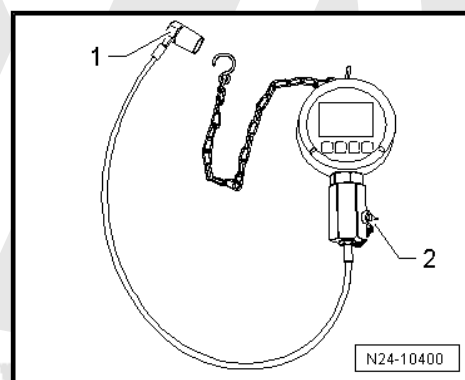
- ◆ ***Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to ⇒ [P1.2 recautions", page 2](#).***

- Remove the engine cover. Refer to ⇒ [C3.1 over", page 17](#).
- Remove the Fuel Pressure Sensor -G247-. Refer to ⇒ [F4.6 uel Pressure Sensor G247 ", page 417](#).
- Coat the sealing point on the Pressure Sensor Tester - Adapter 2 -VAS6394/2- with clean engine oil and install in the fuel rail.



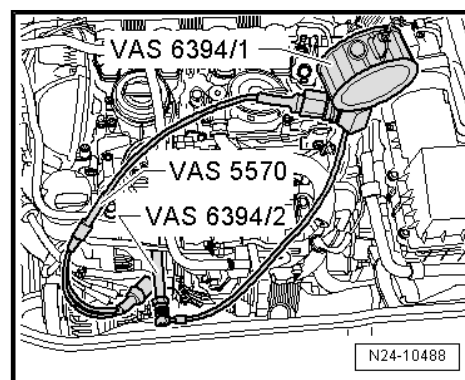
Tightening specification: 27 Nm

- Remove the sealing plug -2- and attach the Fuel Pressure Sensor -G247- to the Pressure Sensor Tester -VAS6394/1-.



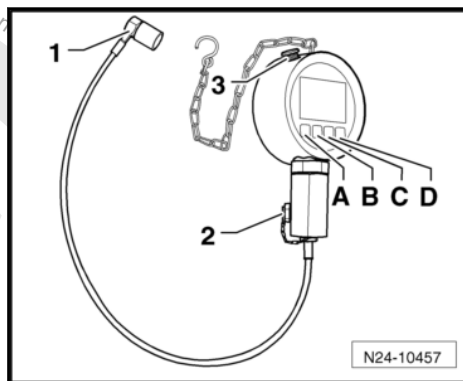
Tightening specification: 27 Nm

- Connect the Pressure Sensor Tester -VAS6394/1- pressure line to the Adapter -VAS6394/2-.
- Connect the Fuel Pressure Sensor -G247- and the Fuel Pressure Sensor -G247- connector using the Vehicle Diagnostic Tester - Test Adapter - 3 Pin -VAS5570-.



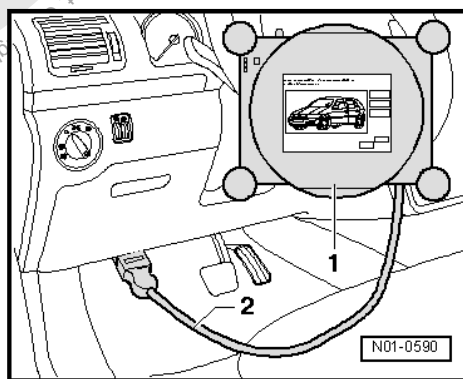
- Switch the Pressure Sensor Test - Digital Manometer - VAS6394/1- on by pressing the button -A- briefly.





#### Note

- ◆ Holding the button -A- for 2 seconds switches on the illumination for 20 seconds.
- ◆ If the Pressure Sensor Tester -VAS6394/1- does not display 0 bar, set it back to zero. Refer to the Operating Manual.
- Connect the Vehicle Diagnostic Tester -1- as follows:



- Connect diagnostic cable -2- to Data Link Connector (DLC) in driver footwell.
- Switch the ignition on.
- On the following screens, select:

OBD

01 - engine electronics ►

011 - measured values ►

- Select measured values block 1 4 0 and confirm with Q.

Display field 3 shows the fuel pressure actual value as measured by the Fuel Pressure Sensor -G247-.

- Start engine and let run at idle.
- Compare the pressure displayed on the Pressure Sensor Tester -VAS6394/1- with the actual value displayed on the Vehicle Diagnostic Tester.
- The pressures may have a maximum difference of 5 bar (72.5 psi).





#### WARNING

***The Pressure Sensor Tester - VAS6394/1- is under high fuel pressure! Disconnect the connector from the Fuel Pressure Sensor -G247- when the engine is running. This reduces the pressure to approximately 6 bar. Switch off the ignition. Place a cleaning cloth around the Fuel Pressure Sensor -G247-, then carefully loosen the Fuel Pressure Sensor -G247- to release the residual pressure.***

Difference greater than 6 bar (87 psi):

- Replace the Fuel Pressure Sensor -G247-.
- Repeat the test with the new Fuel Pressure Sensor -G247- and compare both measured values.

If the measured values do not match again:

- Test the wires in "Guided Fault Finding" Vehicle Diagnostic Tester.

### 3.2 Variable Intake Manifold, Checking

#### Special tools and workshop equipment required

- ◆ Hand Vacuum Pump -VAS6213-



#### Note

*Only perform this test if there is a loss of torque. That means there is reduced elasticity or reduced engine acceleration.*

#### Test Conditions

- The Intake Manifold Runner Control Valve - N316- was checked with the Vehicle Diagnostic Tester and is OK.

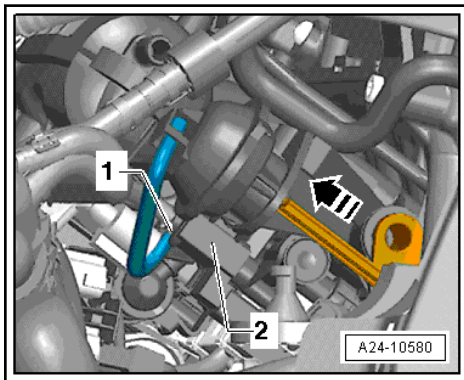
#### Test Sequence



#### Note

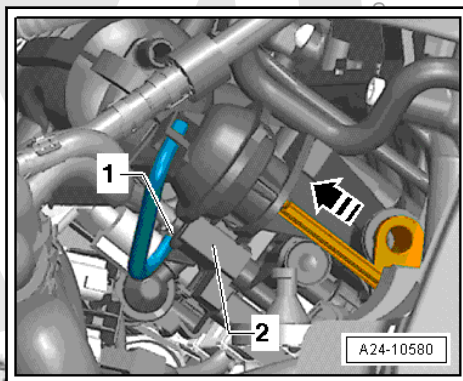
*Overview - fuel rail. Refer to ➔ [-2.3 Fuel Pipe and Fuel Rail-](#), [page 389](#).*

- Remove the engine cover. Refer to ➔ [C3.1 over](#), [page 17](#).
- Start engine and let run at idle.
- Have a second person increase engine speed abruptly (press accelerator pedal).
- Observe the intake manifold change-over vacuum actuator.
- The vacuum actuator must activate in direction of -arrow-.

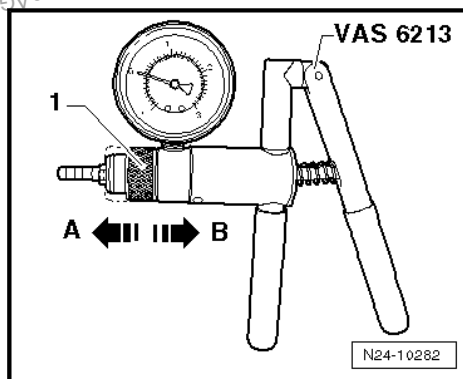


If change-over does not function as specified:

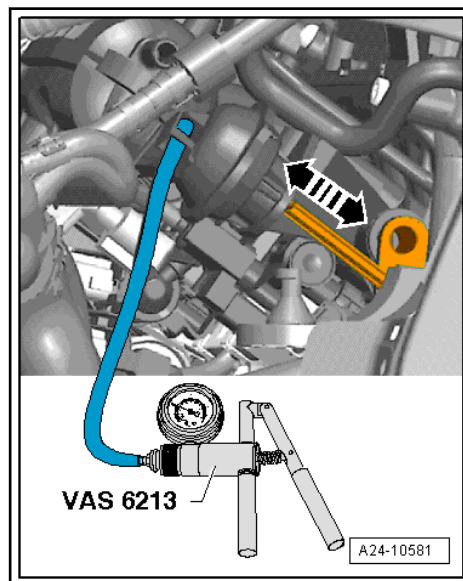
- Check the vacuum system for leaks.
- Check whether the change-over mechanism moves easily. Do this by operating the linkage by hand.
- Check whether the vacuum lines are correctly connected.
- Check that vacuum hoses are not porous.
- Remove the vacuum hose -1- leading to the intake manifold change-over vacuum actuator on the Intake Manifold Runner Control Valve -N316- -2-.



- Set the slide ring -1- on Hand Vacuum Pump -VAS6213- to position -A- for "vacuum".



- Connect the Hand Vacuum Pump -VAS6213- to the vacuum actuator for the intake manifold change-over.



– Operate the Hand Vacuum Pump -VAS6213- several times.

• The vacuum actuator must move in direction of -arrows-.

If the vacuum actuator does not move:

– Replace the vacuum actuator.



## 4 Removal and Installation

⇒ [F4.1 ilter Element", page 402](#)

⇒ [F4.2 ilter Housing", page 404](#)

⇒ [E4.3 ngine Control Module J623, Removing and Installing", page 406](#)

⇒ [I4.4 njectors", page 410](#)

⇒ [I4.5 njector Seals, Replacing", page 414](#)

⇒ [F4.6 uel Pressure Sensor G247 ", page 417](#)

⇒ [P4.7 ressure Pump", page 418](#)

⇒ [M4.8 anifold with Fuel Rail", page 421](#)

⇒ [M4.9 ass Airflow Sensor G70 ", page 429](#)

⇒ [T4.10 hrottle Valve Control Module J338 ", page 430](#)

### 4.1 Air Filter Element

Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Spring Clip Pliers

Removing

Engine Code CBFA

- Disconnect the hose leading to the Secondary Air Injection Pump Motor -V101- from the air filter housing.

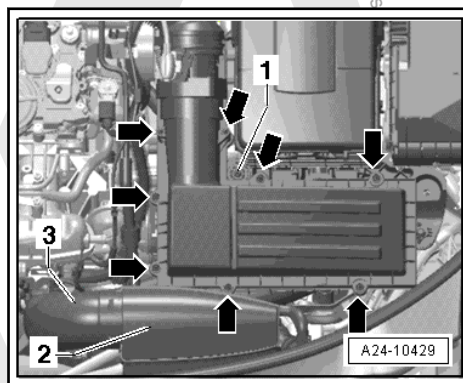


Note

*Press the securing ring to disengage the line.*

Continuation for All Engine Codes

- Remove the bolts -arrows- from the air filter upper section.



- Lift the air filter upper section and remove the air filter element.

Installing

- ◆ Tightening specifications. Refer to ⇒ [-2.2 Air Filter Housing", page 387](#).

Install in reverse order of removal. Note the following:

- ◆ If the air filter is very dirty or soaked, dirt particles or moisture may have contaminated the Mass Airflow Sensor -G70-



and may be causing false mass airflow values. This results in a reduction of power, since a lower injection quantity is calculated.

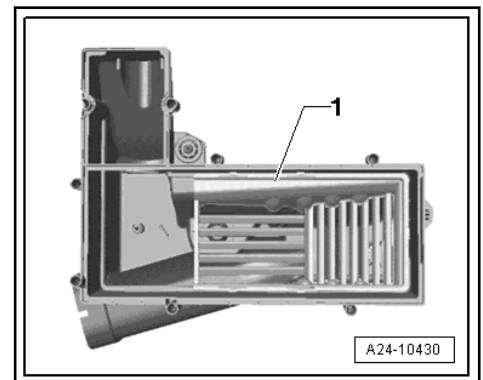
- ◆ Always use original air filter insert. Refer to the Parts Catalog.
- ◆ The hose connections and the hoses must be free of oil and grease before being installed. Use a silicone-free lubricant when installing.
- ◆ The air filter housing must be clean.
- ◆ Install only approved clamps for securing hose connections. Refer to the Parts Catalog.
- ◆ Observe the disposal regulations!

Note the following when blowing out the air filter housing with pressurized air:

- To prevent malfunctions, cover critical air guided components such as the Mass Airflow Sensor -G70-, air intake pipes, etc. with a clean cloth.
- Check the Mass Airflow Sensor -G70- and air duct hose (intake air side) for salt residue, dirt, and leaves.

Check the intake duct up to the air filter insert for contamination. If any contaminants are discovered, clean the air filter housing upper and lower section of salt residue, dirt and leaves. Wash or vacuum if necessary.

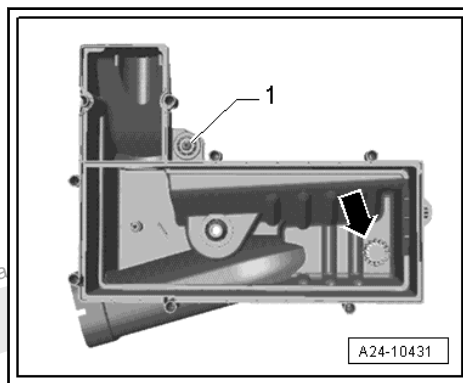
- Check the intake air guide for dirt.
- Remove and clean the snow screen -1-.



#### Note

*The snow screen is not installed on all vehicles.*

- Clean the water drain -arrow- and the air filter lower section.



- Make sure that air filter is properly centered when placed in the mounting of the air filter housing lower section.
- Set the air filter upper section carefully onto the air filter lower section, without using much force. When doing this, make sure that the upper section of air filter housing is not placed crooked onto the air filter element. Check the sealing lip on the air filter element.

Install in reverse order of removal.

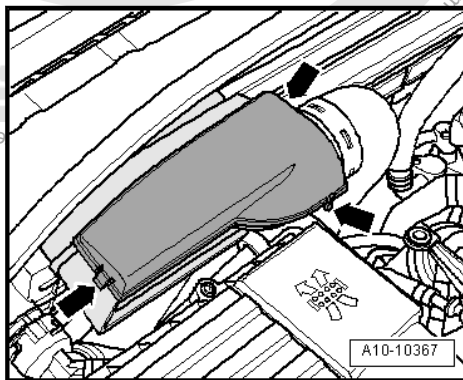
## 4.2 Air Filter Housing

### Special tools and workshop equipment required

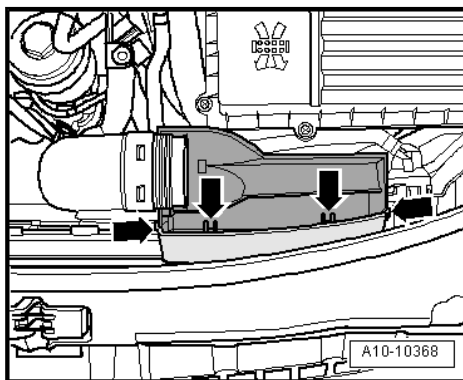
- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-
- ◆ Spring Clip Pliers

### Removing

- Disengage the side clips -arrows- and remove the cover for the air duct.

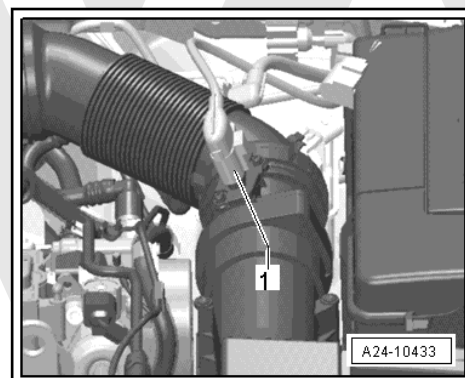


- Disengage the wire retainers -arrows- to unclip the lower air duct.

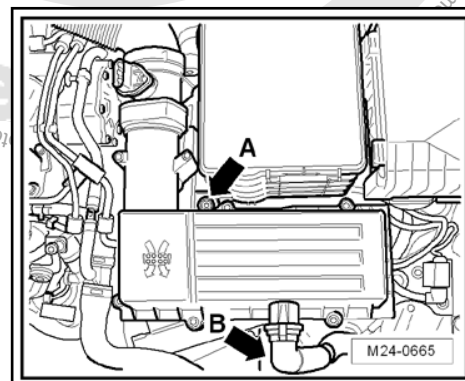




- Remove both the lower air guide and the air guide hose.
- Disconnect the connector -1- from the Mass Airflow Sensor -G70-.



### Engine Code CBFA



- Remove the secondary air pump to the Secondary Air Injection Pump Motor -V101- from the air filter upper section -arrow B-.



### Note

*Press the securing ring to disengage the line.*

### Continuation for All Engine Codes

- Loosen the bolt -arrow A- and pull the air filter housing upward out of the bracket.
- Remove air filter housing together with the Mass Air Flow Sensor and connecting pipe.

### Installing

- ◆ Tightening specifications. Refer to [⇒ -2.2 Air Filter Housing-, page 387](#).

Install in reverse order of removal. Note the following:

- ◆ The hose connections and the hoses must be free of oil and grease before being installed. Use a silicone-free lubricant when installing.
- ◆ Install only approved clamps for securing hose connections. Refer to the Parts Catalog.
- Check the Mass Airflow Sensor and air duct hose (intake air side) for salt residue, dirt, and leaves.
- Check the intake air guide for dirt.





## 4.3 Engine Control Module -J623-, Removing and Installing

⇒ [C4.3.1 ontrol Module without Anti-Theft Protection](#), page 406

⇒ [C4.3.2 ontrol Module with Anti-Theft Protection](#), page 407

### 4.3.1 Engine Control Module without Anti-Theft Protection

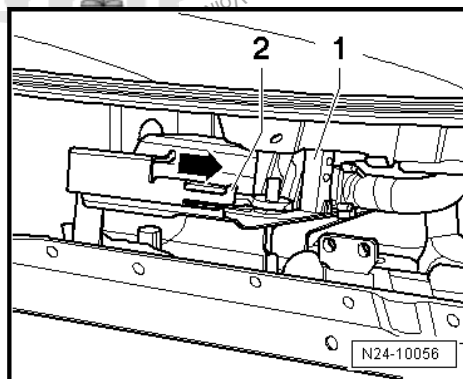


#### Note

*If the Engine Control Module (ECM) will be replaced, connect the Vehicle Diagnostic Tester and perform the "Replacing Engine Control Module" guided function.*

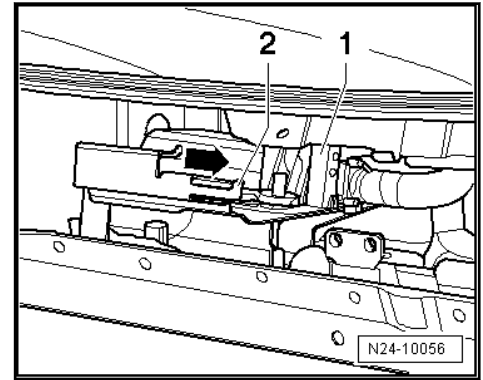
#### Removing

- Switch off the ignition.
- Remove the wiper arm and the plenum chamber cover.
- Remove the plenum chamber bulkhead. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the front connector -1- from ECM.
- Pry up locking mechanism -2- slightly.
- Then slide the ECM out of the retainer -arrow-.
- Disconnect the rear connector from the ECM.



#### Installing

- Connect and lock the rear connector to the ECM.
- Slide the ECM onto the retaining plate.
- Push the locking mechanism -2- against the ECM.



- Now connect and lock the front connector -1- to the ECM.
- Install the plenum chamber bulkhead. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.
- Install the wiper arm and the plenum chamber cover. Refer to ⇒ Electrical Equipment; Rep. Gr. 92; Removal and Installation.

### 4.3.2 Engine Control Module with Anti-Theft Protection

#### Special tools and workshop equipment required

- ◆ Window Cutter -VAG1561A-
- ◆ Window Cutter -Saw Set -VAG1561/14-
- ◆ Hot air gun from the Wiring Harness Repair Set - VAS1978B-.
- ◆ Attachment nozzle from Wiring Harness Repair Set - VAS1978B-.
- ◆ Locking pliers



#### Note

*If the Engine Control Module (ECM) will be replaced, connect the Vehicle Diagnostic Tester and perform the "Replacing Engine Control Module" guided function.*

#### Removing

- Switch off the ignition.
- Remove the wiper arms and the plenum chamber cover. Refer to ⇒ Electrical Equipment; Rep. Gr. 92; Removal and Installation.
- Remove the plenum chamber bulkhead. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation



#### Note

*The threads of the shear bolts are equipped with locking compound. By heating the shear bolts using a hot air gun, the adhesive effect of the locking compound is lowered.*

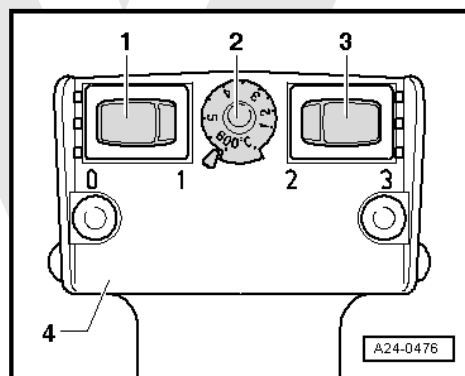


### Caution

**Cover the wires, connectors and control modules near the ECM to prevent them from being burned.**

Perform the adjustments on the hot air gun -4- as shown:

- Turn the temperature setting potentiometer -2- to the maximum heating output (600 °C (1112 °F)).



- Move the two stage switch for air quantity -3- to position 3.



### WARNING

**By heating the shear bolts, parts of the protective housing are heated intensely. Wear protective gloves to prevent injuries.**

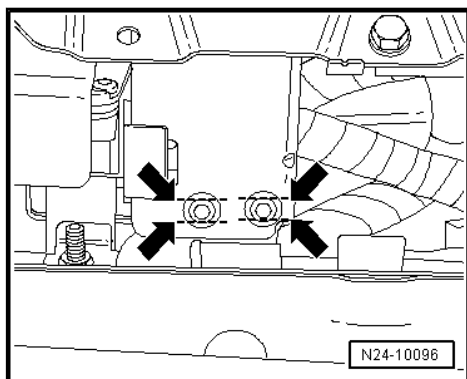
- Guide nozzle of hot air gun on to shear bolts.
- Switch on heat gun and heat bolt for approximately 20 to 25 seconds.
- Remove the shear bolt by the bolt head with Pliers.

The procedure for the second shear bolt is exactly the same.

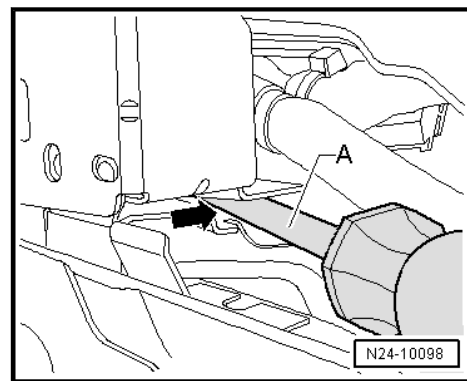


### Note

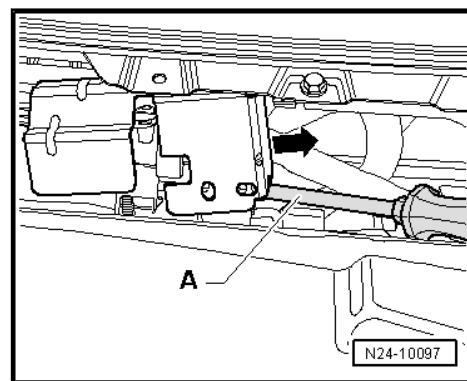
**If bolts cannot be removed, saw into heads of shear bolts so that two parallel surfaces are formed -arrows- and then remove them.**



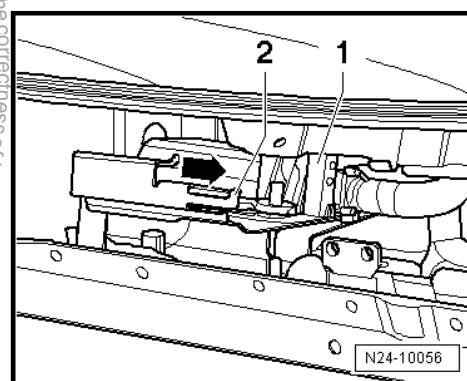
- Insert a screwdriver -A- between the protective housing and the retaining plate -arrow-.



- Pry off the protective housing with a screwdriver -A- and pull it off the retaining plate -arrow-.

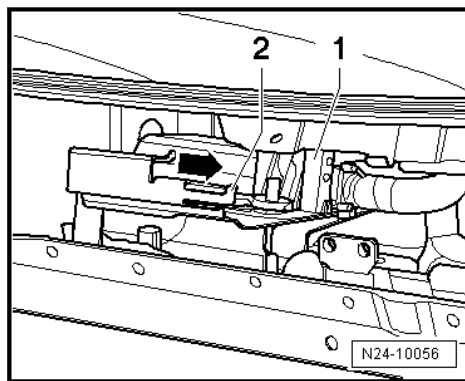


- Disconnect the front connector -1- from ECM.
- Pry up locking mechanism -2- slightly.
- Then slide the ECM out of the retainer -arrow-.
- Disconnect the rear connector from the ECM.

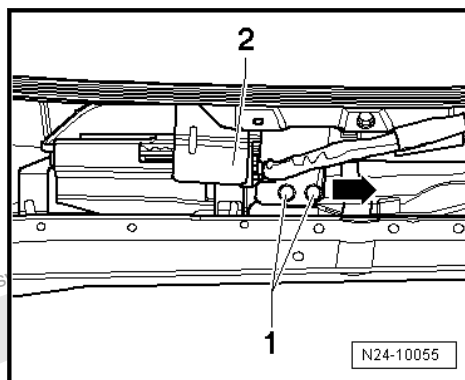


#### Installing

- Connect and lock the rear connector to the ECM.
- Slide the ECM onto the retaining plate.
- Push the locking mechanism -2- against the ECM.



- Now connect and lock the front connector -1- to the ECM.
- Slide the protective housing on to the retaining plate.
- Tighten the shear bolts -1- uniformly until bolt heads shear off.



- Install the plenum chamber bulkhead. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the wiper arms and the plenum chamber cover. Refer to ➤ Electrical Equipment; Rep. Gr. 92; Removal and Installation.

## 4.4 Fuel Injectors

### Special tools and workshop equipment required

- ◆ Injector/Combustion Chamber Seal Tool Set -T10133B-



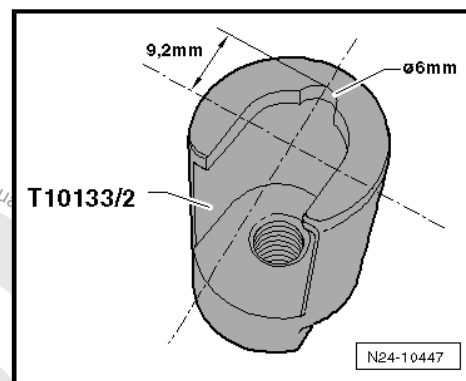
#### Note

*The Puller -T10133/2- was changed and is now identified as Puller -T10133/2A-. If the new tool is not available, the old one can be modified. Refer to ➤ [page 410](#).*

### Puller -T10133/2- to Puller -T10133/2A-, Reworking

#### Procedure

- File the semi-circle using a Round File (approximately 6 mm) as shown.

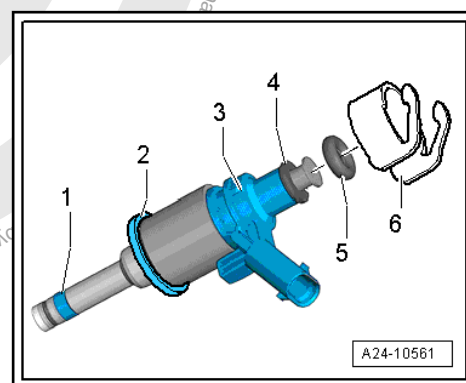


#### Note

*The semi-circle allows the Remover to slide farther on to the Fuel Injector, thus providing the Puller with a larger contact surface.*

- Mark the modified Puller with an “A” at the end of the tool number.

#### Fuel Injector (Old Version)



1 - Combustion chamber seal (Teflon® seal), replacing When installing, the ring must not be greased or handled with any other lubricants.

2 - An intermediate ring shall replace the support ring; refer to fuel injector (new version).

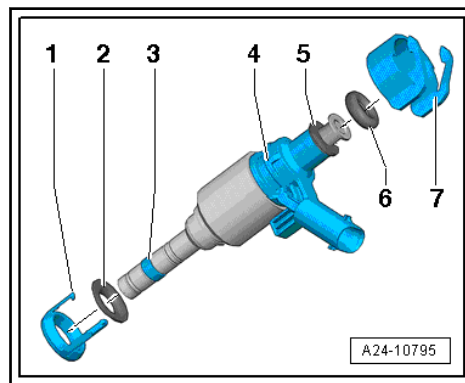
3 - Fuel injector

4 - Spacer ring (replace if damaged)

5 - O-Ring (replace, coat lightly with clean engine oil when installing)

6 - Support ring (via this support ring, the fuel rail utilizes the force to hold the fuel injector in place in the cylinder head).

#### Fuel Injector (New Version)



- 1 - Intermediate ring, replace
- 2 - Mount
- 3 - Combustion chamber seal (Teflon® seal), replacing When installing, the ring must not be greased or handled with any other lubricants.
- 4 - Fuel injector
- 5 - Spacer ring (replace if damaged)
- 6 - O-Ring (replace, coat lightly with clean engine oil when installing)
- 7 - Support ring (via this support ring, fuel rail utilizes the force to hold the fuel injector in place in the cylinder head).

#### Removing

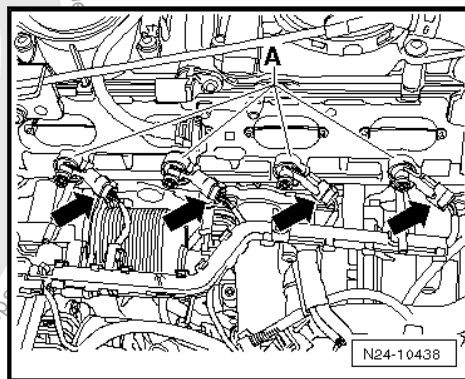
- Remove the intake manifold with the fuel rail. Refer to [M4.8 anifold with Fuel Rail](#), page 421 .
- Cover the intake channels with a clean cloth.



#### Note

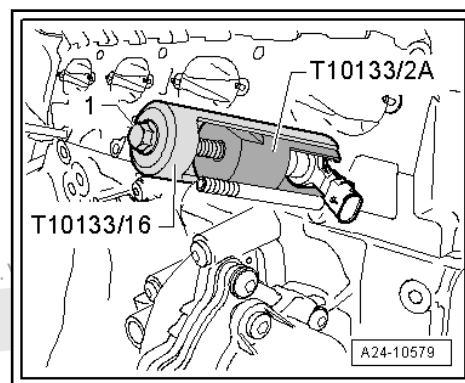
*If the Fuel Injectors remain stuck in the fuel rail, carefully pull them out of the fuel rail pipe.*

- Remove the support element -A- downward and disconnect the connector -arrows- from the Fuel Injectors.



- Place the Puller -T10133/2A- into the groove on the Fuel Injector.





- Mount the Injector/Combustion Chamber Seal - Removal Tool -T10133/16- and remove the Fuel Injector by turning the bolt -1-.

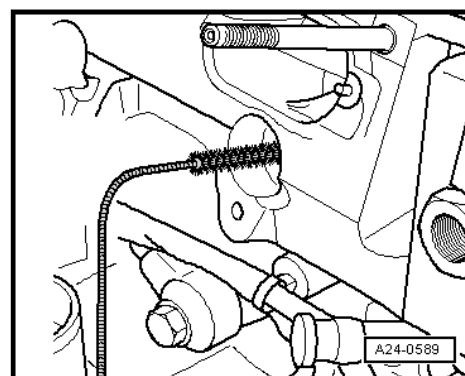
### Note

- ◆ Pay attention to the intermediate rings.
- ◆ If new Fuel Injectors are not going to be installed, then clean the old Fuel Injectors before installing. Refer to [⇒ I1.1 injectors, Cleaning", page 378](#).
- ◆ The combustion chamber seal (Teflon® seal) must always be replaced before re-installing the Fuel Injector. Refer to [⇒ I4.5 injector Seals, Replacing", page 414](#).

### Installing

### Note

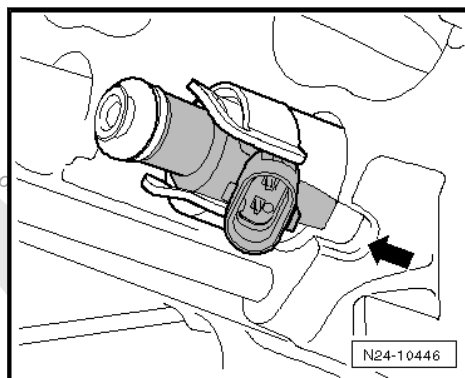
- ◆ Combustion chamber sealing ring (Teflon® sealing ring) for the Fuel Injectors must not be oiled or greased.
  - ◆ It is possible an opened intake valve may hinder the cleaning of bores in cylinder head. In this case, engine must be turned farther by hand using a screw wrench on the crankshaft.
- Thoroughly clean the Fuel Injectors holes in cylinder head using the Injector/Combustion Chamber Seal Tool Set - Nylon brush -T10133/4-.



- Replace the Fuel Injectors combustion chamber seal (Teflon® seal). Refer to [⇒ I4.5 injector Seals, Replacing", page 414](#).

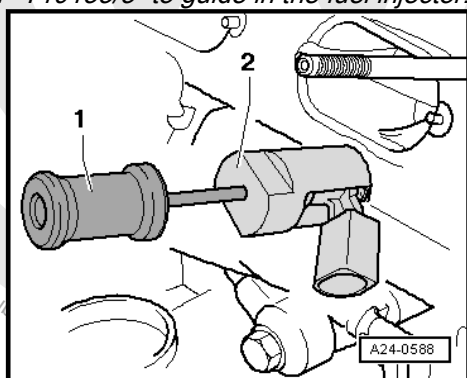


- Assemble the fuel injector with the parts from the repair kit.
- Press the fuel injector by hand into cylinder head (free of oil and grease) until they stop. Make sure the fuel injectors are positioned correctly -arrow- inside the cylinder head.



#### Note

If it is difficult to install the fuel injector by hand, use the Injector/Combustion Chamber Seal Tool Set - Puller -T10133/2A- -2- with the Sliding Hammer -T10133/3- to guide in the fuel injector.



- Install the support ring onto the fuel injector.
- Lightly coat O-rings for the high pressure fuel injector with clean engine oil before installing
- Install the intake manifold with the fuel rail. Refer to ➤ [M4.8 anifold with Fuel Rail", page 421](#) .

## 4.5 Fuel Injector Seals, Replacing

### Special tools and workshop equipment required

- ◆ Injector/Combustion Chamber Seal Tool Set -T10133B-
- ◆ Brass Brush

### Procedure



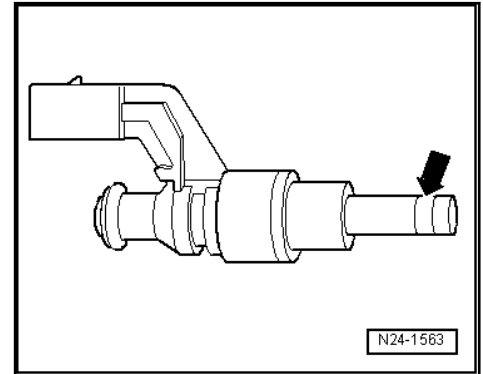
#### Note

Combustion chamber sealing ring (Teflon® sealing ring) for the Fuel Injectors must not be oiled or greased.

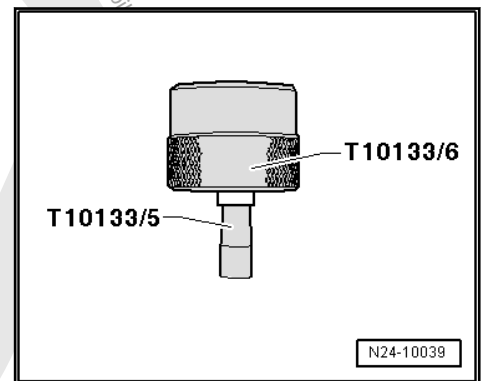
- Clean the Injector Valves. Refer to ➤ [I1.1 njectors, Clean- ing", page 378](#) .



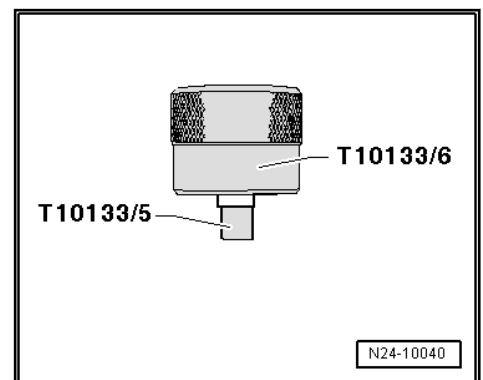
- Carefully remove the old combustion chamber seal (Teflon® seal) with the appropriate tool, for example, with cut the seal open with a razor and spread seal open with a small screwdriver and pull it forward and off. When doing this, make sure not to damage the groove -arrow- and circumferential rib in the groove base.



- Carefully clean the Fuel Injectors around the groove -arrow- and the base of the groove. Remove any deposits (coking) using a brass wire brush.
- Insert a new sealing ring onto the Injector/Combustion Chamber Seal Tool Set - Assembly Cone -T10133/5-.



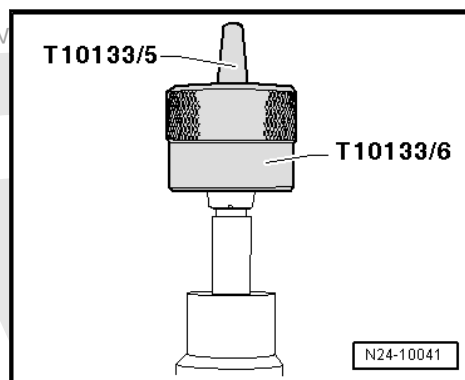
- Slide the seal as far as possible onto the Injector/Combustion Chamber Seal Tool Set - Assembly Cone -T10133/5- using the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve -T10133/6-.
- Rotate the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve -T10133/6- and slide the seal up to the end of the Injector/Combustion Chamber Seal Tool Set - Assembly Cone -T10133/5-.



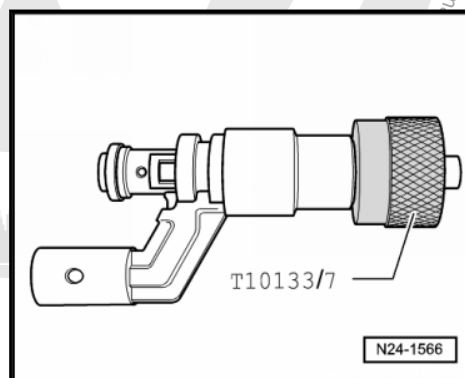
- Set the Injector/Combustion Chamber Seal Tool Set - Assembly Cone -T10133/5- onto the Fuel Injector and slide



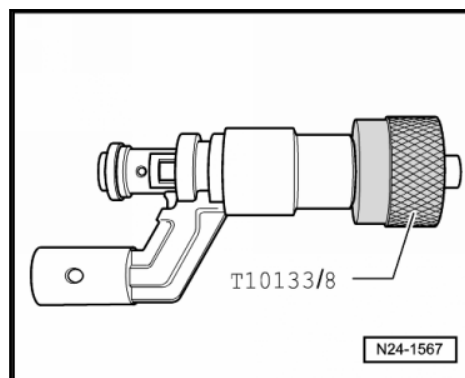
the seal onto the Fuel Injector using the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve -T10133/6-.



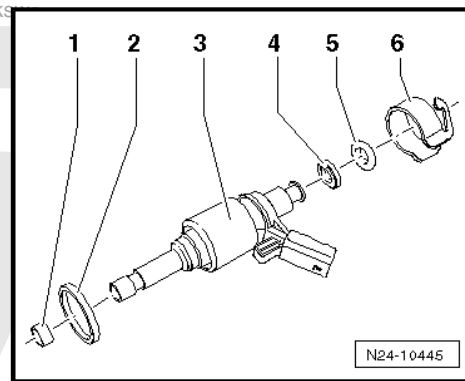
- Remove the Injector/Combustion Chamber Seal Tool Set - Assembly Cone -T10133/5- and slide the seal into the groove with the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve -T10133/6-
- Press the Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve -T10133/7- all the way onto the Fuel Injector using a gentle turning motion (approximately 180°).



- Pull off the Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve -T10133/7- again using turning motion in opposite direction.
- Now press the Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve -T10133/8- all the way onto the Fuel Injector using a gentle turning motion (approximately 180°).



- Pull off the Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve -T10133/8- again using turning motion in opposite direction.
- Replace the Fuel Injector O-ring -5- and support ring -4-.



## 4.6 Fuel Pressure Sensor -G247-

### Special tools and workshop equipment required

- ◆ Elbow Assembly Tool -T10118-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Double Hexagon Socket - 27mm -VAS5301/7-

### Removing



#### Note

Overview - fuel rail. Refer to ➤ [-2.3 Fuel Pipe and Fuel Rail-](#), [page 389](#).

- Read the safety precautions before starting. Refer to ➤ [P1.2 recautions](#)", [page 2](#).
- Follow all the guidelines for clean working conditions. Refer to ➤ [f1.1 or Clean Working Conditions](#)", [page 1](#).

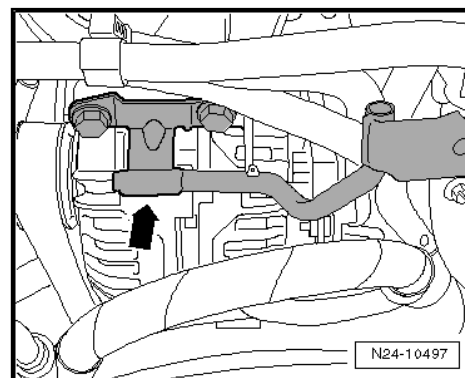


### WARNING

***The fuel system is under pressure!***

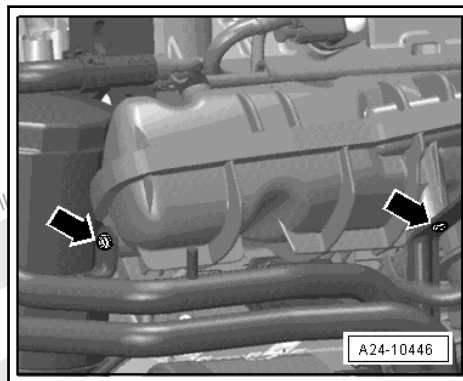
- ◆ ***Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to ➤ [P1.2 recautions](#)", [page 2](#).***

- If equipped, remove the charge air guide to the sound generator.
- Remove the bracket -arrow- on the top of the Generator -C-.

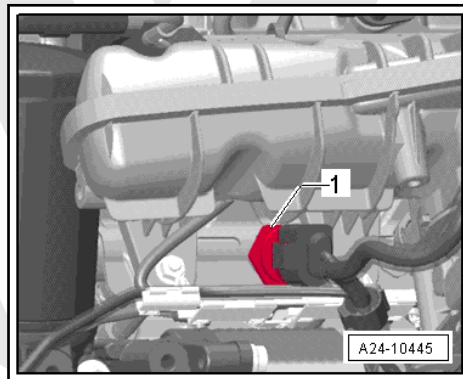




- Remove the bolts -arrows- for the coolant line from the intake manifold.



- Release the connector from the Fuel Pressure Sensor - G247- -1- using the Elbow Assembly Tool -T10118-. Then remove the connector.



- Remove the Fuel Pressure Sensor -G247- using the Double Hexagon Socket - 27mm -VAS5301/7-.
- Collect escaping fuel with a cleaning cloth.

#### Installing

Install in reverse order of removal. Note the following:

- ◆ Coat the Fuel Pressure Sensor -G247- sealing point with clean engine oil and install it in the fuel rail.
- ◆ Tightening specification. Refer to ➔ [-2.3 Fuel Pipe and Fuel Rail-, page 389](#) , Overview - Fuel Rail.

## 4.7 High Pressure Pump

#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Spring Clip Pliers

#### Removing

#### Conditions

- The engine is cold.



#### Note

- ◆ Overview - high pressure pump with Fuel Pressure Regulator Valve - N276-. Refer to ➤ [O2.4 overview - High Pressure Pump](#), page 391 .
- ◆ The high pressure pump can only be removed and installed when the engine is cold.
- ◆ When installing the high pressure pump, make sure that no dirt enters the fuel system.
- ◆ Catch escaping fuel with a cleaning cloth.
- ◆ Always replace the O-ring and the connection.
- ◆ Always install the high pressure fuel lines so that they are free of tension.

#### Procedure

- Read the safety precautions before starting. Refer to ➤ [P1.2 recautions](#), page 2 .
- Follow all the guidelines for clean working conditions. Refer to ➤ [f1.1 or Clean Working Conditions](#), page 1 .

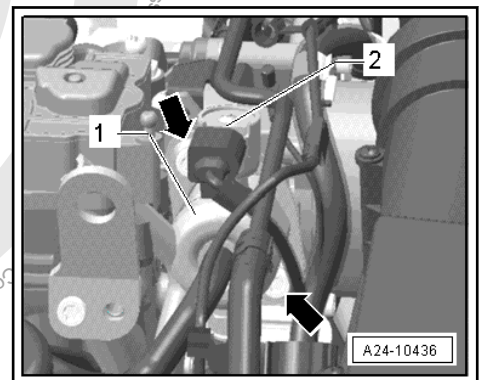


#### WARNING

**The fuel system is under pressure!**

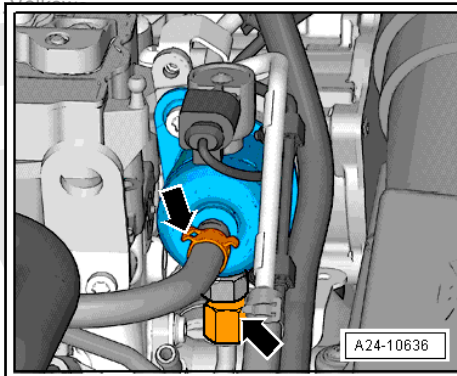
- ◆ Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to ➤ [P1.2 recautions](#), page 2 .

- Remove the engine cover. Refer to ➤ [C3.1 over](#), page 17 .
- Disconnect the connector -2- from the Fuel Pressure Regulator Valve -N276-.

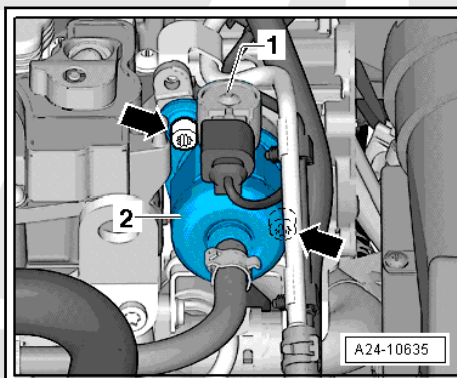


- Open both fuel lines -arrows-.





- Remove the two bolts -arrows-.



- Carefully remove the high pressure pump. The roller tappet may stay in the cylinder head.

### Installing



#### Note

- ♦ To insert the high pressure pump, the roller tappet must be at its lowest point.
- ♦ If the same or a used high pressure pump is installed, replace the fuel supply line connections (high pressure side). Overview - high pressure pump -Item 11- ➔ [Item 11 \(page 393\)](#).

#### Tightening specification:

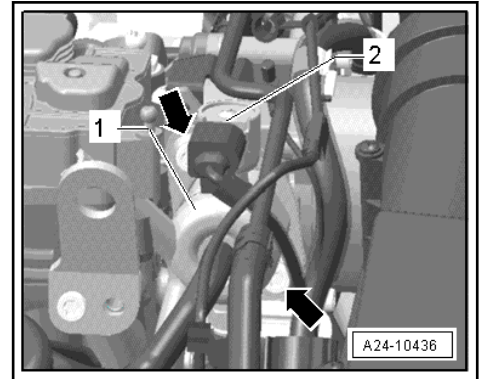
- ♦ Overview - intake manifold. Refer to ➔ [-2.5 Intake Manifold](#)", [page 393](#).
- ♦ Overview - high pressure pump with Fuel Pressure Regulator Valve - N276-. Refer to ➔ [O2.4 overview - High Pressure Pump](#)", [page 391](#).

#### Install in reverse order of removal. Note the following:

- ♦ When installing the high pressure pump, make sure that no dirt enters the fuel system.
- ♦ The O-ring must always be replaced.
- ♦ Always install the high pressure fuel line so that it is free of tension.
- Replace high pressure pump O-ring.
- Insert the roller tappet in the vacuum pump after checking the tappet for damage.



- Rotate the crankshaft until the roller tappet is at the lowest point.
- Install the high pressure pump into the vacuum pump.
- Tighten the bolts -arrows- by hand.



- Replace the connections on the high pressure pump.
- Tighten the bolts -arrows- diagonally to the required tightening specification.
- Tighten the fuel supply line union nut first by hand, »align so it is free of stress« and then tighten it.
- Reconnect the connector -2- to the Fuel Pressure Regulator Valve -N276-.
- If the fuse was pulled, insert it again.
- Check the fuel system for leaks. Refer to ➤ [S3.2 system. Checking for Leaks](#), page 295.

## 4.8 Intake Manifold with Fuel Rail

### Special tools and workshop equipment required

- ◆ Wrench - Oil Filter -3417-
- ◆ Torx Socket - T30 -T10347-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Elbow Assembly Tool -T10118-



#### Note

*If the intake manifold is replaced, the Intake Manifold Runner Position Sensor -G336- must be adapted to the Engine Control Module -J623-. Refer to Vehicle Diagnostic Tester "Guided Function".*

Fuel rail, separating from the intake manifold. Refer to ➤ [page 428](#).



## Removing



### Note

- ♦ To access the Fuel Injectors, the intake manifold and the fuel rail with air control charge motion valve must be removed.
- ♦ The combustion chamber seal (Teflon®) and the O-ring must always be replaced.
- ♦ Overview - intake manifold. Refer to [⇒ -2.5 Intake Manifold", page 393](#).
- ♦ Overview - fuel rail. Refer to [⇒ -2.3 Fuel Pipe and Fuel Rail", page 389](#).
- Read the safety precautions before starting. Refer to [⇒ P1.2 recautions", page 2](#).
- Follow all the guidelines for clean working conditions. Refer to [⇒ f1.1 or Clean Working Conditions", page 1](#).

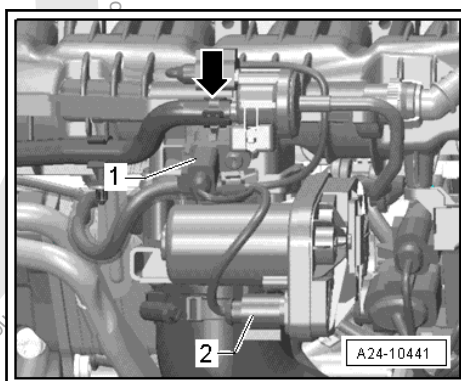


### WARNING

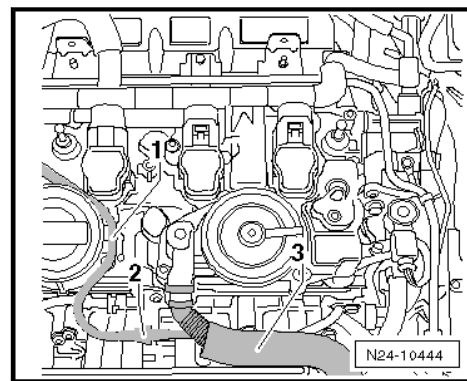
**The fuel system is under pressure!**

- ♦ Before opening high pressure components of the fuel injection system, the fuel pressure must be relieved to residual pressure. Refer to [⇒ P1.2 recautions", page 2](#).

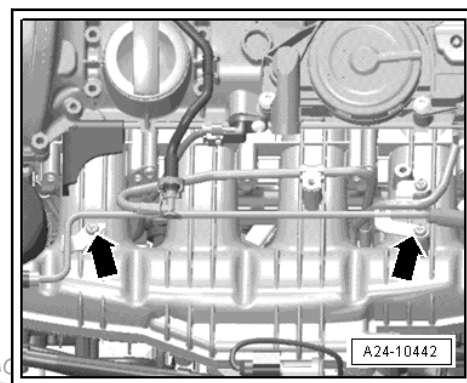
- Remove the engine cover. Refer to [⇒ C3.1 over", page 17](#).
- If equipped, remove the charge air guide to the sound generator.
- Clean the contact surface from the intake manifold to the cylinder head.
- Remove the air filter. Refer to [⇒ F4.2 ilter Housing", page 404](#).
- Disconnect the vent line -arrow- from the Evaporative Emission (EVAP) canister and disconnect the connector on the EVAP Canister Purge Regulator Valve 1 -N80-.



- Disconnect the following electrical connectors as well:
  - 1 - Intake Air Temperature Sensor -G42-
  - 2 - Throttle Valve Control Module -J338-
- Disconnect the vacuum line -1- at the separating point -2- and remove the crankcase ventilation hose -3-.



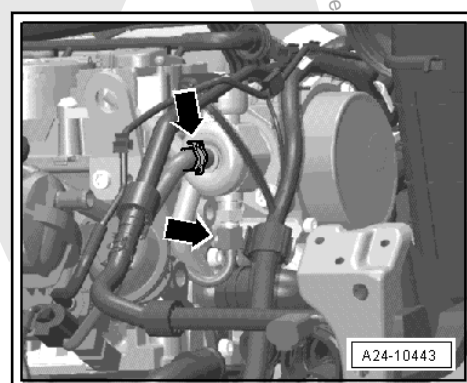
- Remove the bolts -arrows- for the fuel supply line and lay the line to the side.



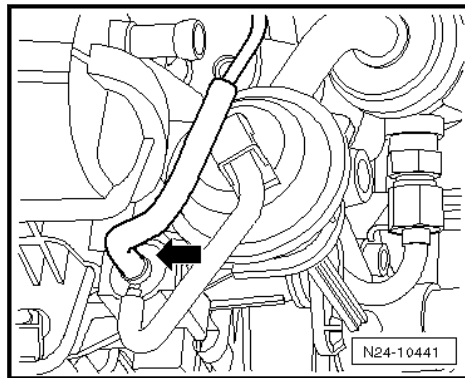
#### WARNING

*The fuel system must have no pressure. Refer to ➔ **P1.2 re-cautions**, page 2 .*

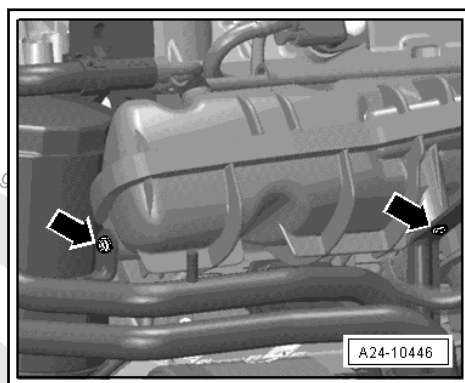
- Loosen the union nut -lower arrow- on the high pressure fuel line.



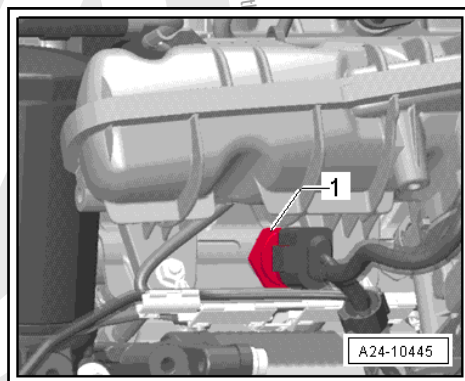
- Disconnect the vacuum line -arrow- from the Intake Manifold Runner Control Valve -N316-.



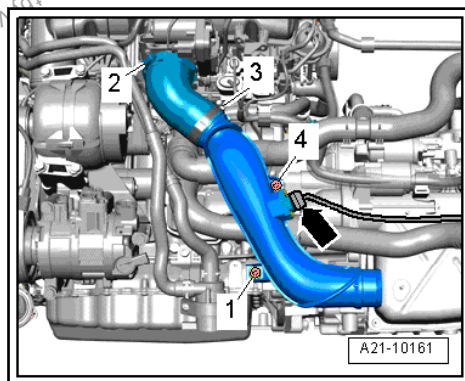
- Remove the bolts -arrows- for the coolant line from the intake manifold.



- Release the connector from the Fuel Pressure Sensor - G247- -1- using the Elbow Assembly Tool -T10118-. Then remove the connector.



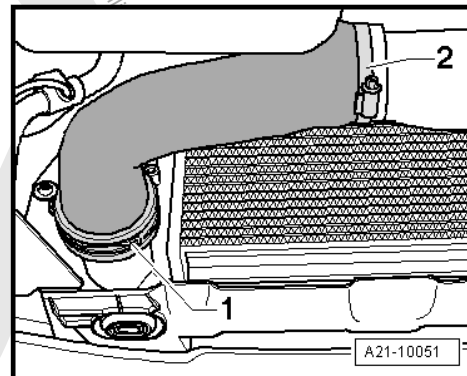
- Loosen the hose clamp -2-



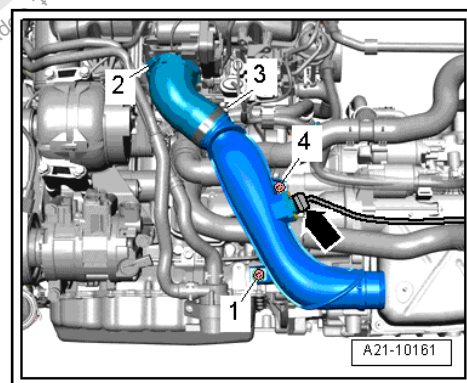
- Remove the bolt -4-.



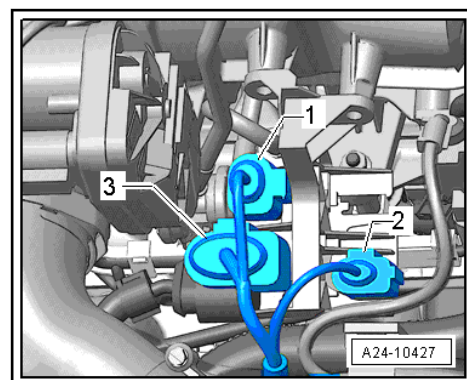
- Disconnect the connector -arrow-.
- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



- Seal off the connections on the charge air cooler with a clean cloth.
- Remove the bolt -1- and remove the air guide pipe downward.

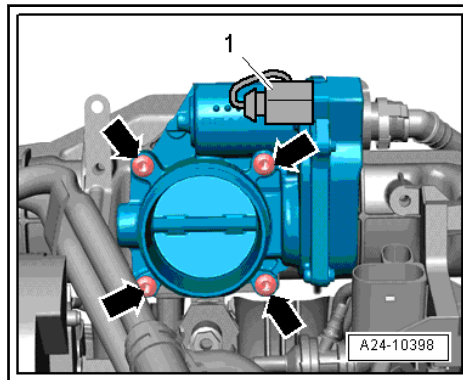


- Disconnect the connectors -1 through 3- and remove the bracket from the intake manifold.

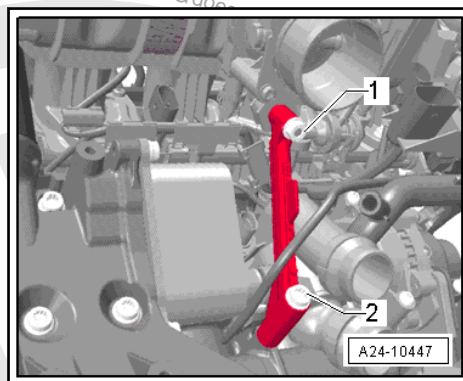


- 1 - From Camshaft Position Sensor -G40-
- 2 - From Knock Sensor 1 -G61-
- 3 - 8-Pin Connector for Fuel Injectors
- Remove the Throttle Valve Control Module -J338- -arrows-.

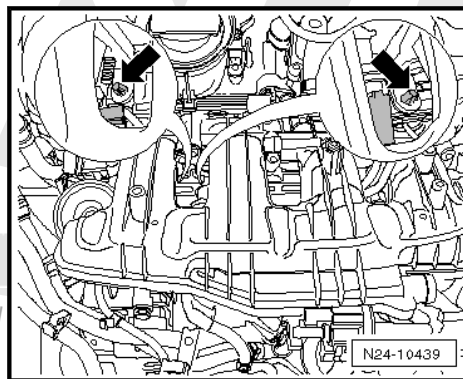




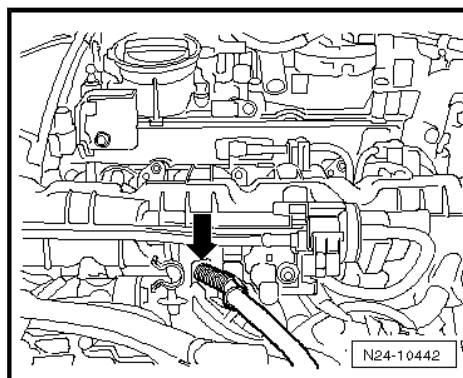
- Remove the intake manifold bracket by removing the mounting nut -1- and bolt -2-.



- Remove the oil filter. Refer to ⇒ [-2-2 Oil Filter Housing/Oil Pressure Switch F1](#), page 201, Overview - Oil Pressure Switch -F1-.
- Loosen the line bracket -arrows-.



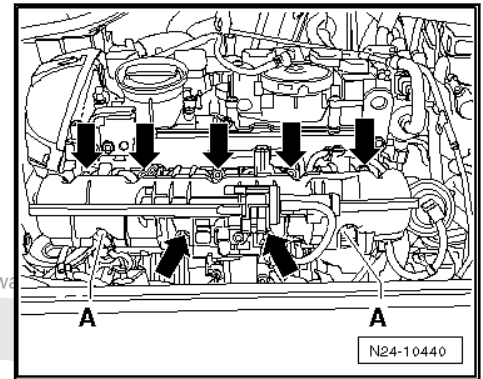
- Loosen the line -arrow- from the intake manifold.



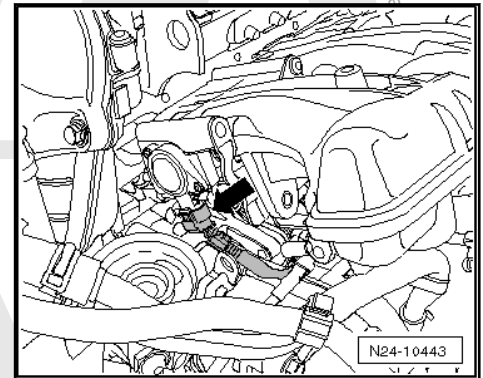




- Remove the nuts -A- and loosen the bolts -arrows- from the intake manifold using the Torx Socket - T30 -T10347-.



- Carefully pull the intake manifold and fuel rail away from the cylinder head just a little.
- Disconnect the connector -arrow- from the Intake Manifold Runner Position Sensor -G336- and remove the intake manifold.



- Cover the intake channels with a clean cloth.



#### Note

*The Fuel Injectors could remain stuck in the fuel rail.*

- Fuel rail, separating from the intake manifold. Refer to ➤ [page 428](#) .

#### Installing

##### Conditions

- Fuel injectors sit inside the cylinder head. Install the Fuel Injectors. Refer to ➤ [14.4 injectors", page 410](#) .
- Mount the intake manifold onto the cylinder head on the stud bolts (lower left and right).



#### Note

*Make sure the Fuel Injectors installed correctly and pay attention to the wiring bracket when mounting the intake manifold (located under the intake manifold).*

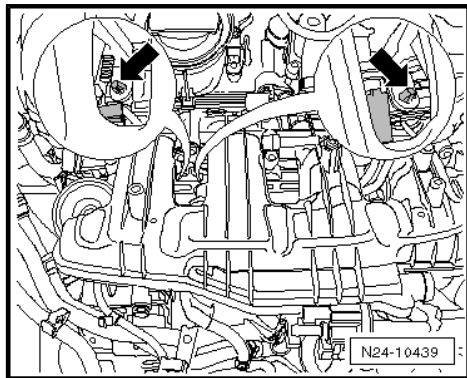
- When installing the intake manifold, pull the manifold back out slightly and the Fuel Injectors will remain in the fuel rail,



then remove the Fuel Injectors again from the fuel rail and insert the Fuel Injectors back into the cylinder head.

Install in reverse order of removal. Note the following:

- ◆ When attaching the bracket onto the intake manifold, make sure it clips into both latches.



#### Tightening Specification

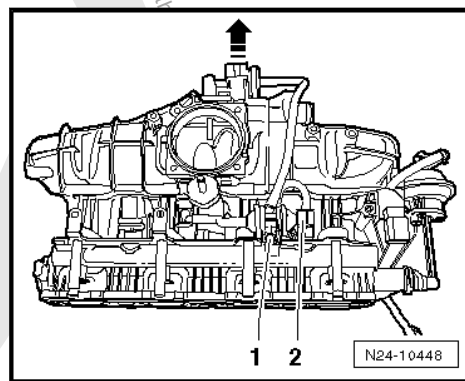
- ◆ Overview - intake manifold. Refer to ➤ [-2.5 Intake Manifold](#)", [page 393](#) .
- ◆ Overview - fuel rail. Refer to ➤ [-2.3 Fuel Pipe and Fuel Rail](#)", [page 389](#) .

#### Fuel Rail, Separating from Intake Manifold

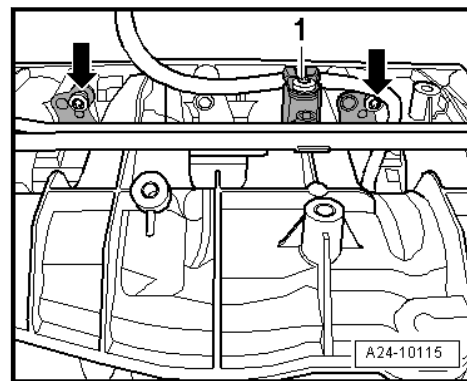
##### Conditions

- The intake manifold must be removed. Refer to ➤ [M4.8 anti-fold with Fuel Rail](#)", [page 421](#)

##### Disconnecting



- Remove the EVAP Canister Purge Regulator Valve 1 -N80-  
-arrow- from the bracket.
- Loosen the double check-valve -1- and the bleed line -2-, if  
equipped.
- Open the hose clamp -1-.



- Remove both bolts -arrows- from the fuel rail.
- Remove the fuel rail from the intake manifold.

### Installing

Install in reverse order of removal. Note the following:

- Tighten the fuel line.
- Tightening specification:
- ◆ Overview - fuel rail. Refer to ➔ [-2.3 Fuel Pipe and Fuel Rail](#), page 389 .
  - Install the intake manifold with the fuel rail. Refer to ➔ [M4.8 anifold with Fuel Rail](#), page 421 .

## 4.9 Mass Airflow Sensor -G70-

### Special tools and workshop equipment required

- ◆ Spring Clip Pliers

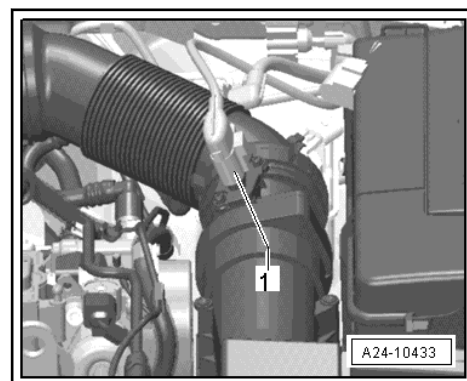


### Note

*The Intake Air Temperature Sensor 2 -G299- and the Mass Airflow Sensor -G70- are integrated in one housing.*

### Removing

- Disconnect the connector -1- from the Mass Airflow Sensor -G70-.
- Remove the air duct hose on the Mass Airflow Sensor -G70-.
- Remove both bolts from the Mass Airflow Sensor -G70- and carefully remove the Mass Airflow Sensor -G70- from the guide on the air filter upper section.





## Installing

For problem-free operation of the Mass Airflow Sensor -G70- it is very important to observe the following notes and procedures.



### Note

- ◆ *If the air filter is very dirty or soaked, dirt particles or moisture may have contaminated the Mass Airflow Sensor -G70- and may be causing false mass airflow values. This results in a reduction of power, since a lower injection quantity is calculated.*
- ◆ *Always use original air filter insert. Refer to the Parts Catalog.*
- ◆ *Use a lubricant (silicone-free) for installing the intake hose.*
- ◆ *The hose connections and the hoses must be free of oil and grease before being installed. Use a silicone-free lubricant when installing.*
- ◆ *Install only approved clamps for securing hose connections. Refer to the Parts Catalog.*
- Check the Mass Airflow Sensor -G70- and air duct hose (intake air side) for salt residue, dirt, and leaves.
- Check the intake duct up to the air filter insert for contamination. If any contaminants are discovered, clean the air filter housing upper and lower section of salt residue, dirt and leaves. Wash or vacuum if necessary. air filter, removing and installing. Refer to [⇒ F4.1 Filter Element](#), page 402 .

Installation is performed in reverse order of the removal.

- Replace the O-ring.
- Tighten the screws to 3.5 Nm.

## 4.10 Throttle Valve Control Module -J338-

### Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

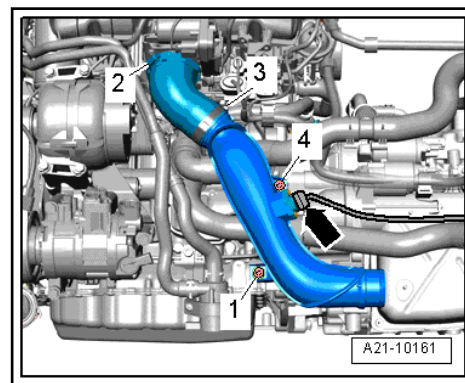
### Removing



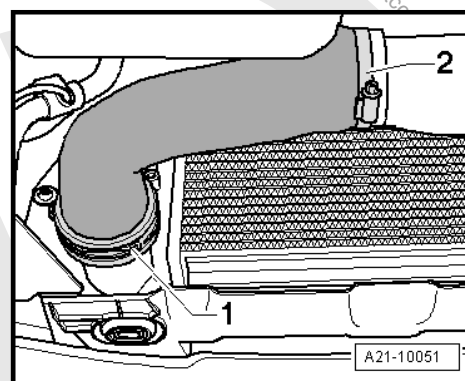
### Note

Overview - intake manifold. Refer to [⇒ -2.5, Intake Manifold](#), page 393 .

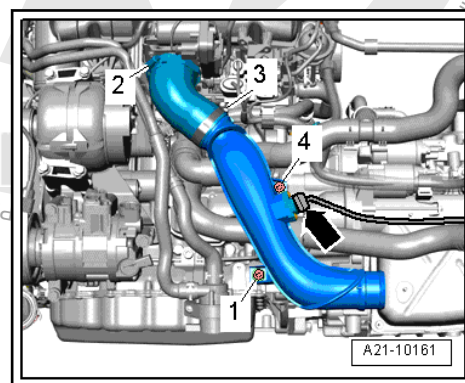
- Follow all the guidelines for clean working conditions. Refer to [⇒ f1.1 or Clean Working Conditions](#), page 1 .
- If equipped, remove the charge air guide to the sound generator.
- Loosen the hose clamp -2-.



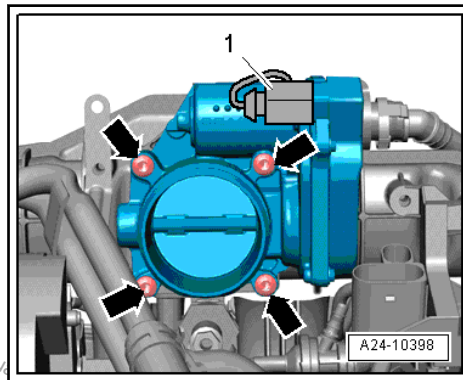
- Remove the bolt -4-.
- Disconnect the connector -arrow-.
- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.
- Disconnect the charge air hose by lifting the clamps -1- and loosening the hose clamp -2-.



- Seal off the connections on the charge air cooler with a clean cloth.
- Remove the bolt -1- and remove the air guide pipe downward.



- Disconnect the connector -1- at the Throttle Valve Control Module -J338-.
- Remove the bolts -arrows- and remove the Throttle Valve Control Module -J338-.



### Installing

- ◆ Tightening specification. Refer to ⇒ [-2.5 Intake Manifold-](#), [page 393](#).

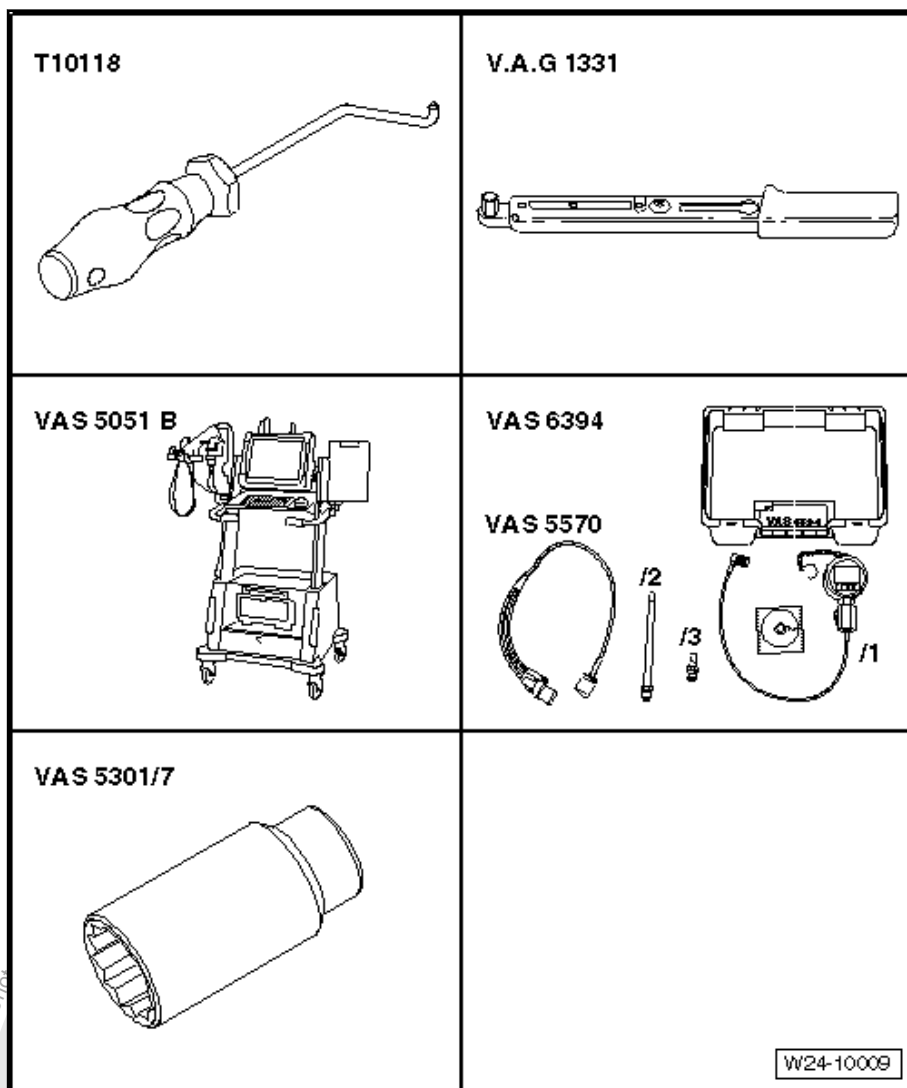
Install in reverse order of removal. Note the following:

- Clean the gasket sealing surface.
- Replace the gasket.
- The position indicator on the seal must fit into the groove provided for it inside the intake manifold.
- If the Throttle Valve Control Module -J338- was replaced, adapt the Engine Control Module to the Throttle Valve Control Module -J338- using the Vehicle Diagnostic Tester. Refer to Vehicle Diagnostic Tester “Guided Functions”.



## 5 Special Tools

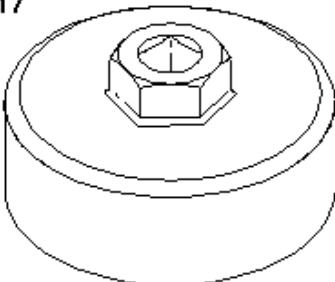
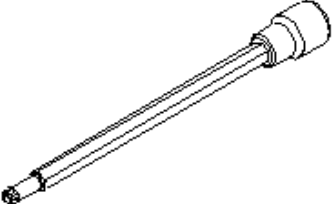

Special tools and workshop equipment required



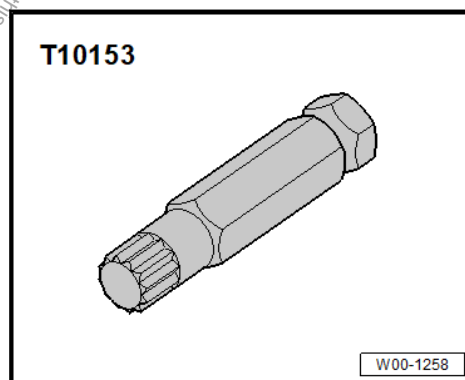
- ◆ Elbow Assembly Tool -T10118-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Vehicle Diagnostic Tester
- ◆ Pressure Sensor Tester -VAS6394/1- with Pressure Sensor Tester - Adapter 2 -VAS6394/2-
- ◆ Double Hexagon Socket - 27mm -VAS5301/7-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 3 Pin -VAS5570-
- ◆ Vehicle Diagnostic Tester





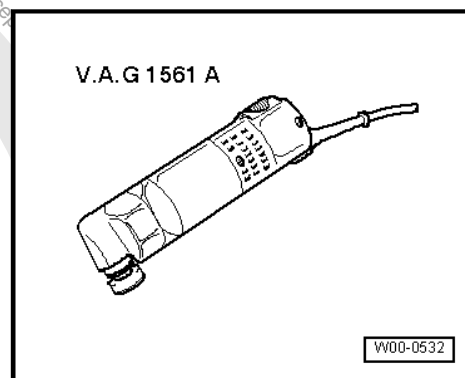
<b>3417</b> 	<b>T10347</b> 
<b>V.A.G 1331</b> 	
	<b>W24-10007</b>

- ◆ Wrench - Oil Filter -3417-
- ◆ Torx Socket - T30 -T10347-
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Elbow Assembly Tool -T10118- (not illustrated)
- ◆ Injector/Combustion Chamber Seal Tool Set -T10133B-



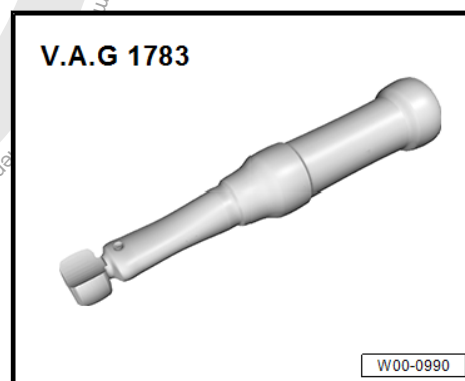


◆ Window Cutter -VAG1561A-

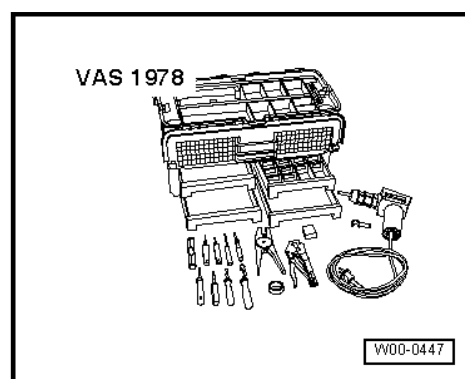


◆ Window Cutter - Saw Set -VAG1561/14-

◆ Torque Wrench 1783 - 2-10Nm -VAG1783-

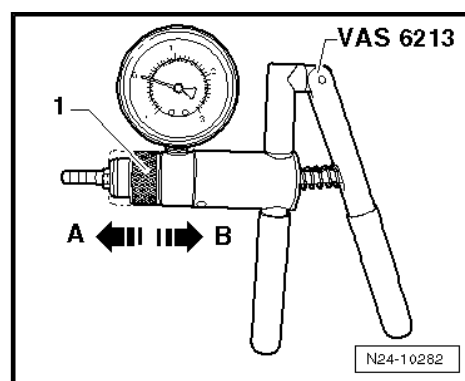


◆ Hot air gun from the Wiring Harness Repair Set - VAS1978B-.



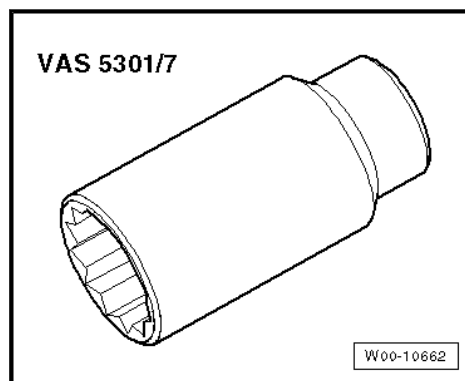
◆ Attachment nozzle from Wiring Harness Repair Set - VAS1978B-.

◆ Hand Vacuum Pump -VAS6213-





- ◆ Double Hexagon Socket - 27mm -VAS5301/7-



- ◆ Ultrasonic Cleaning Unit -VAS6418-
- ◆ Ultrasonic Cleaning Unit - Mounting Plate for Injection Modules -VAS6418/1-
- ◆ Ultrasonic Cleaning Unit - Cleaning Fluid -VAS6418/2-



## 26 – Exhaust System, Emission Controls

### 1 Description and Operation

⇒ -1.1 Muffler", page 437

⇒ -1.2 Secondary Air Injection System", page 440

#### 1.1 Overview - Muffler



### 1 - Heated Oxygen Sensor - G39-

- ☐ 55 Nm
- ☐ Bank 1, sensor 1
- ☐ Only coat the thread with hot bolt paste. Refer to the Parts Catalog
- ☐ Make sure the hot bolt paste does not get into the slits in the sensor body.

### 2 - Front Exhaust Pipe with Catalytic Converter



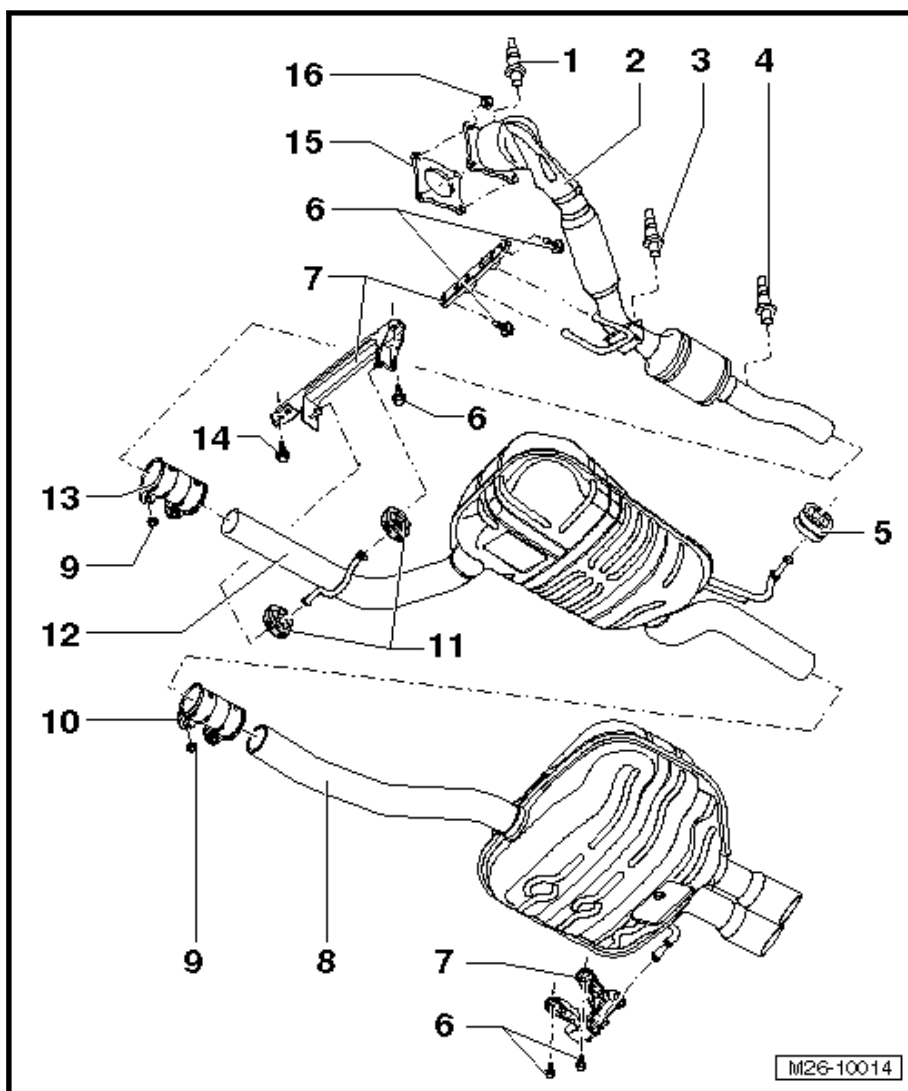
Caution

**Risk of damaging the decoupling element:**  
**Do not bend the decoupling element more than 10°.**

**Do not stretch the decoupling element.**

**Do not damage the wire mesh on the decoupling element.**

- ☐ Protect catalytic converter from shocks and impact stress
- ☐ Removing and installing. Refer to ➤ [E3.2 Exhaust Pipe](#), page 444.
- ☐ Align the exhaust system free of stress. Refer to ➤ [S3.3 System, Installing without Tension](#), page 447.
- ☐ Exhaust system, checking for leaks. Refer to ➤ [S2.1 System, Checking for Leaks](#), page 442.



### 3 - Heated Oxygen Sensor

- ☐ 55 Nm
- ☐ Only coat the thread with hot bolt paste. Refer to the Parts Catalog
- ☐ Make sure the hot bolt paste does not get into the slits in the sensor body.

Only on engine code CBFA:

- ☐ Heated Oxygen Sensor 2 -G108-
- ☐ Bank 1, sensor 2

### 4 - Oxygen Sensor after Three Way Catalytic Converter -G130-

- ☐ 55 Nm
- ☐ Only coat the thread with hot bolt paste. Refer to the Parts Catalog
- ☐ Make sure the hot bolt paste does not get into the slits in the sensor body.

Engine code CBFA:

- ☐ Bank 1, Sensor 3

Engine codes CCTA:

- ☐ Bank 1, sensor 2



#### 5 - Retaining Loop

- ☐ Replace if damaged
- ☐ Follow the parts number

#### 6 - Bolt

- ☐ 23 Nm

#### 7 - Mount

- ☐ Replace if damaged

#### 8 - Rear Muffler

- ☐ In original equipment as one unit with front muffler. For repairs, replace each separately
- ☐ Exhaust system, separating and connecting. Refer to [⇒ P3.1 ipes/Mufflers, Separating", page 443](#) .
- ☐ Align the exhaust system free of stress. Refer to [⇒ S3.3 ystem, Installing without Tension", page 447](#) .
- ☐ Exhaust system, checking for leaks. Refer to [⇒ S2.1 ystem, Checking for Leaks", page 442](#) .

#### 9 - Nut

- ☐ 23 Nm

#### 10 - Rear Clamping Sleeve

- ☐ For individual replacement of front and rear mufflers
- ☐ Note the installation position. Refer to [⇒ Fig. ""Clamping Sleeve Location"" , page 439](#) .
- ☐ Tighten the bolted connections evenly

#### 11 - Retaining Loop

- ☐ Replace if damaged
- ☐ Follow the parts number

#### 12 - Front Muffler

- ☐ Original equipment as one unit with the rear muffler. For repairs, replace each separately
- ☐ Exhaust system, separating and connecting. Refer to [⇒ P3.1 ipes/Mufflers, Separating", page 443](#) .
- ☐ Align the exhaust system free of stress. Refer to [⇒ S3.3 ystem, Installing without Tension", page 447](#) .
- ☐ Exhaust system, checking for leaks. Refer to [⇒ S2.1 ystem, Checking for Leaks", page 442](#) .

#### 13 - Front Clamping Sleeve

- ☐ Before tightening the exhaust system, adjust it when it is cold so that it is free of tension. Refer to [⇒ S3.3 ystem, Installing without Tension", page 447](#) .
- ☐ Tighten the bolted connections evenly
- ☐ Note the installation position. Refer to [⇒ Fig. ""Clamping Sleeve Location"" , page 439](#) .

#### 14 - Bolt

- ☐ 26 Nm
- ☐ Always replace
- ☐ For attaching the fuel tank

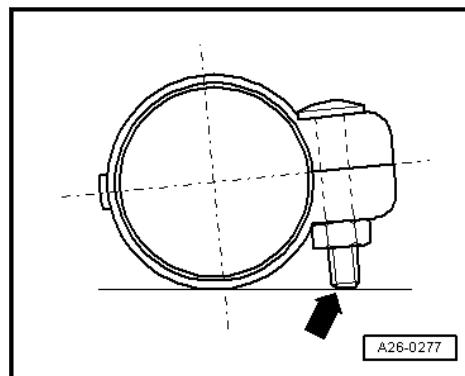
#### 15 - Seal

- ☐ Always replace

#### 16 - Nut

- ☐ 40 Nm
- ☐ Always replace
- ☐ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.

#### Clamping Sleeve Location



- When installing clamping sleeve, ensure that the bolt end -arrow- does not project beyond the lower edge of clamping sleeve:
- Threaded connection points toward the right.
- Tighten the threaded connections equally to 23 Nm.

## 1.2 Overview - Secondary Air Injection System





# **1 - Gasket**

- ☐ Always replace

## **2 - Secondary Air Injection Solenoid Valve -N112-**

- ☐ Removing and installing. Refer to ➤ [S3.5 econdary Air Injection Solenoid Valve N112](#) ", page 450 .

## **3 - Bolt**

- ☐ 9 Nm

## **4 - Secondary Air Injection Sensor 1 -G609-**

## **5 - O-Ring**

- ☐ No Replacement Part
- ☐ If damaged, replace the Secondary Air Injection Sensor 1 -G609-

## **6 - To Air Filter Upper Section**

## **7 - Secondary Air Guide**

- ☐ Make sure it is secure

## **8 - Routing Aid for the Air Filter Drain Line**

## **9 - Nut**

- ☐ 9 Nm

## **10 - Bracket**

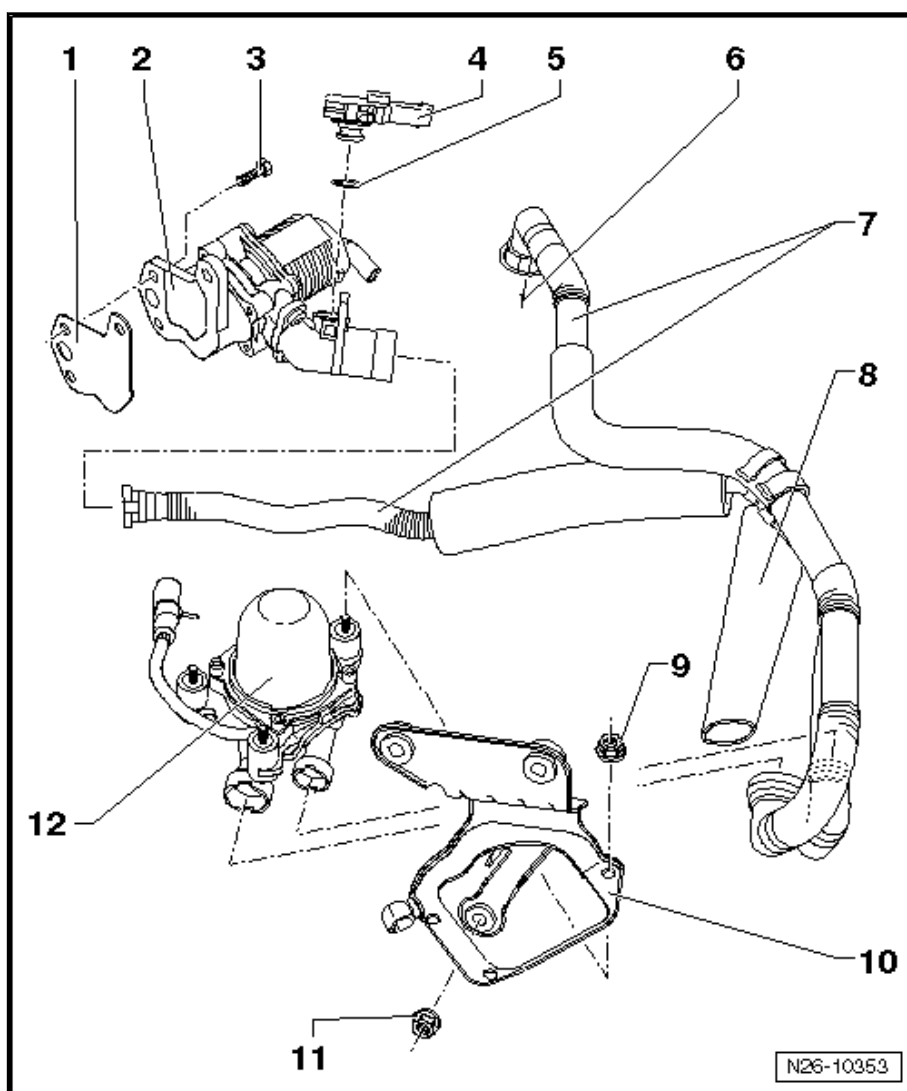
- ☐ For Secondary Air Injection Pump Motor - V101-

## **11 - Nut**

- ☐ 25 Nm

## **12 - Secondary Air Injection Pump Motor -V101-**

- ☐ Removing and installing. Refer to ➤ [S3.4 econdary Air Injection Pump Motor V101](#) ", page 449 .





## 2 Diagnosis and Testing

⇒ **S2.1 ystem, Checking for Leaks", page 442**

### 2.1 Exhaust System, Checking for Leaks

#### Test Sequence

- Start the engine and let it run in idle.
- Seal off the tail pipe with cloths or plug them for the duration of the leak test.
- Check for leaks by listening at connection areas of cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe etc.
- Repair the detected leaks.



### 3 Removal and Installation

⇒ [P3.1 Pipes/Mufflers, Separating", page 443](#)

⇒ [S3.3 System, Installing without Tension", page 447](#)

⇒ [E3.2 Exhaust Pipe", page 444](#)

⇒ [S3.4 Secondary Air Injection Pump Motor V101", page 449](#)

⇒ [S3.5 Secondary Air Injection Solenoid Valve N112", page 450](#)

#### 3.1 Exhaust Pipes/Mufflers, Separating

Special tools and workshop equipment required

- ◆ Pneumatic Body Saw -VAS6780- or
- ◆ Chain Pipe Cutter -VAS6254-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Protective eyewear
- ◆ Protective clothing



#### Note

- ◆ *A separating point has been provided in the connecting pipe for removing, installing and replacing the front and rear muffler.*
- ◆ *The separating point is marked by depressions around the circumference of the exhaust pipe.*

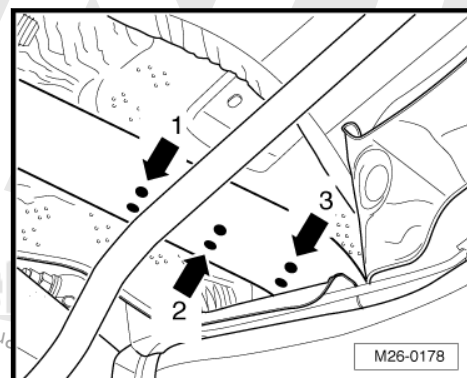
#### Disconnecting



#### WARNING

*To prevent injuries from metal shavings, wear protective goggles and protective clothing.*

- Cut the exhaust pipe at a right angle at the separating point -arrow 2-, for example using a Pneumatic Body Saw -VAS6780- or Chain Pipe Cutter -VAS6254-.





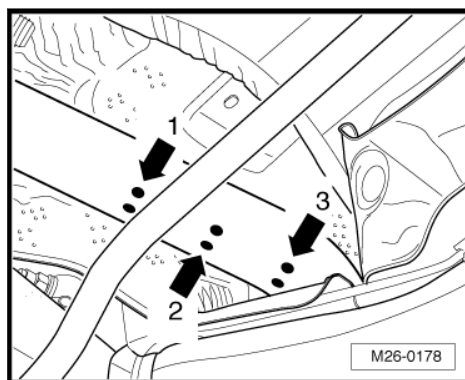
## Joining



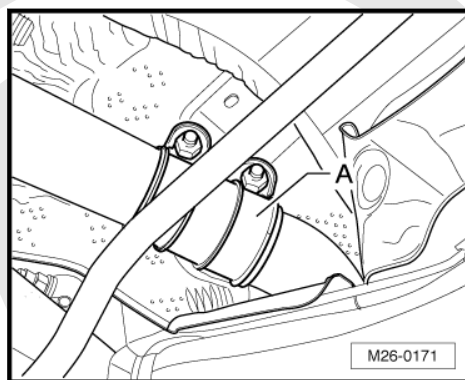
### Note

*A second technician is needed when tightening the rear clamping sleeve (clamping sleeve repair).*

- Secure front muffler in retainers. The front clamp remains loosely connected to pipes.
- Align rear muffler horizontally and hold it in this position.
- When installing, position the rear clamping sleeve at side markings -arrows 1 and 3-.



- Install the rear clamping sleeve -A- as shown and tighten it to 23 Nm.



- Then align exhaust system free of tension. Refer to [S3.3 system, Installing without Tension](#), page 447.

## 3.2 Front Exhaust Pipe

### Special tools and workshop equipment required

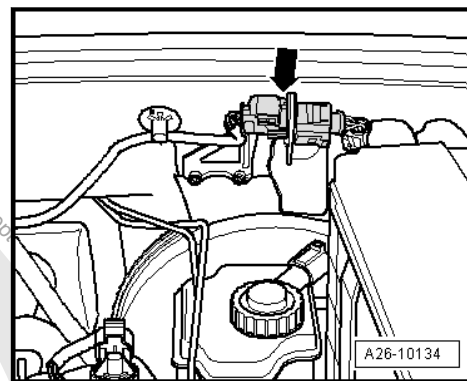
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-
- ◆ Hot Bolt Paste. Refer to the Parts Catalog.

### Removing

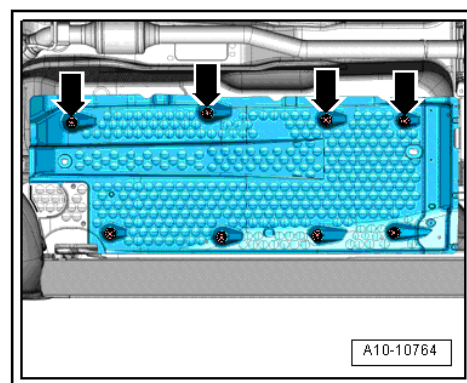
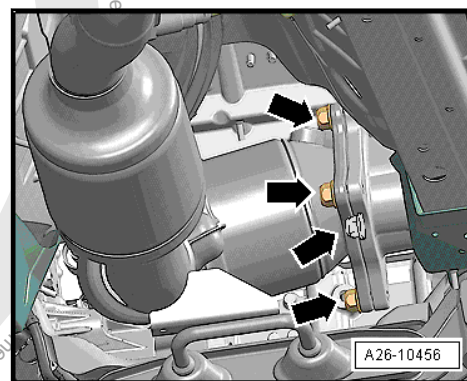
- Disconnect the Heated Oxygen Sensor -G39- connector -arrow- and free up the wiring harness.



- From the top, remove the nuts -arrows- on the connection of the front exhaust pipe connection to the turbocharger.

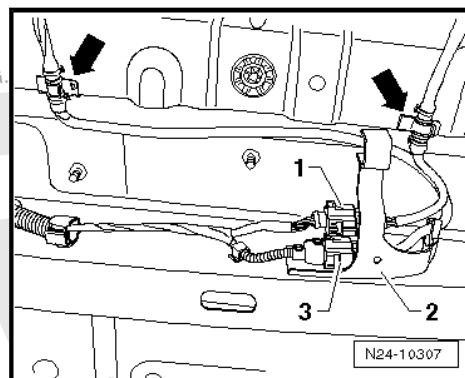


- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove nuts accessible from below from front exhaust pipe to the turbocharger connection.
- Remove the nuts -arrows- and slightly pull the underbody cover downward.





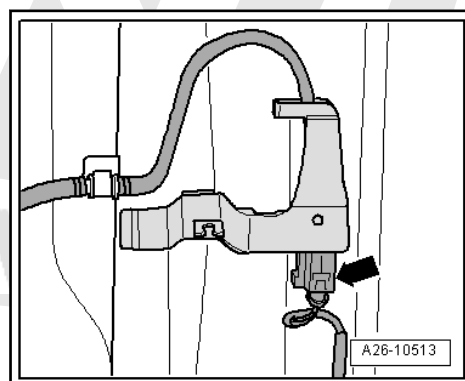
## Engine Code CBFA



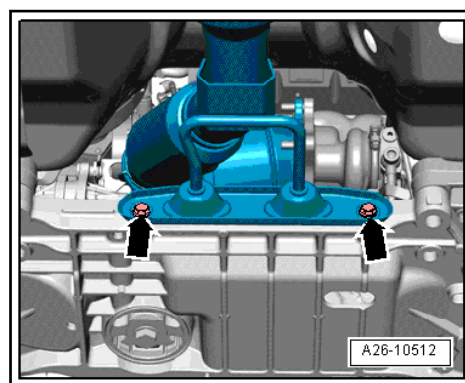
- Unclip the wires -arrows-, remove the bracket -2- and disconnect the electrical connectors -1 and 3-.

## Engine Code CCTA

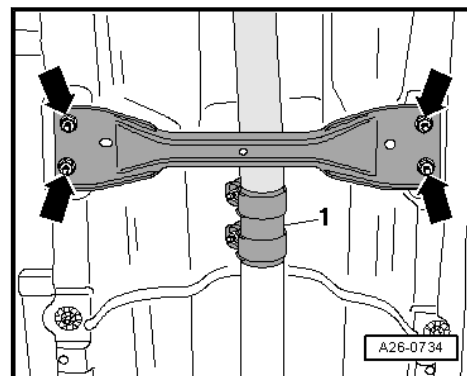
- Disconnect the connector -arrow- on the underbody.
- Remove the connector out of the bracket and free up the wire to the oxygen sensor.



## Continuation for All



- Remove exhaust system suspended mount -arrows-.
- Remove the front tunnel brace for the underbody -arrows-.



#### Caution

##### *Risk of damaging the decoupling element:*

- ◆ *Do not bend the decoupling element more than 10°.*
- ◆ *Do not stretch the decoupling element.*
- ◆ *Do not damage the wire mesh on the decoupling element.*

- Loosen the clamping sleeve -1- and push it rearward.
- Remove front exhaust pipe with catalytic converter.

#### Installing

- ◆ Tightening specifications. Refer to [⇒ -1.1 Muffler", page 437](#)
- ◆ Tunnel bridge to underbody: 20 Nm

Install in reverse order of removal. Note the following:

- ◆ Replace the seals and self-locking nuts.
- ◆ Coat the stud bolts on the exhaust manifold with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.
- ◆ Align the exhaust system free of stress. Refer to [⇒ S3.3 system, Installing without Tension", page 447](#) .
- ◆ Exhaust system, checking for leaks. Refer to [⇒ S2.1 system, Checking for Leaks", page 442](#).

### 3.3 Exhaust System, Installing without Tension

#### Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-

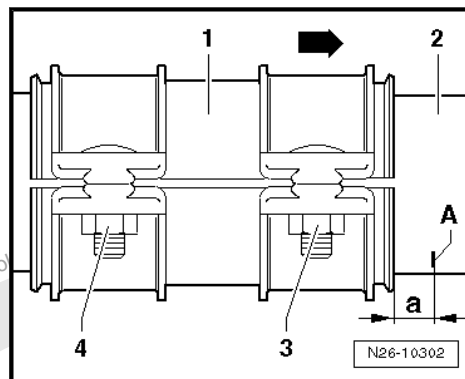
#### Conditions

- Align the exhaust system when it is cold.

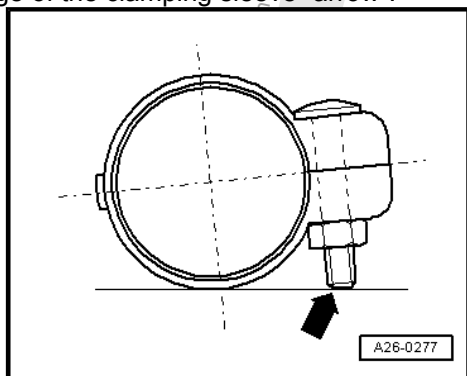
#### Procedure

- Loosen the connections -3 and 4- on the front clamping sleeve -1-.

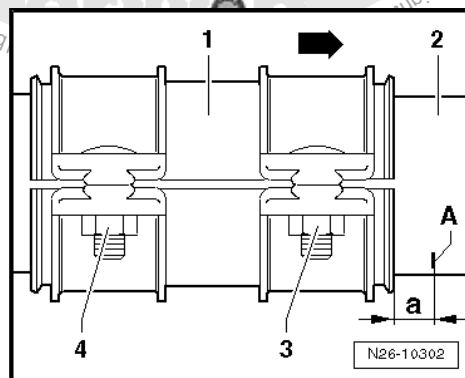




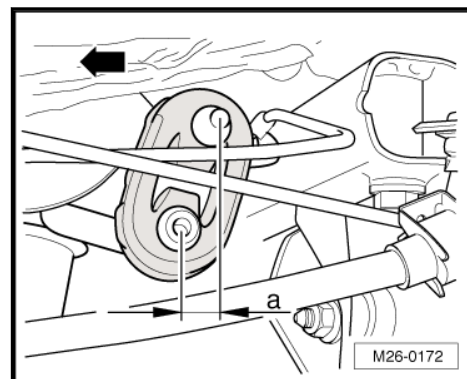
- Align the front clamping sleeve -1- to marking -A- on the front exhaust pipe -2- (-arrow- faces in direction of travel).
- Dimension -a- = 5 mm
- The connections must be at the right and must not project beyond the lower edge of the clamping sleeve -arrow-.



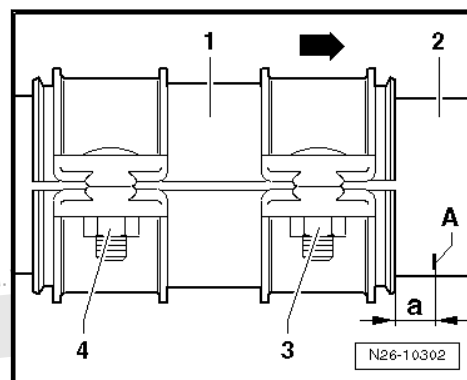
- Hand tighten the front connection -3- on the clamping sleeve.



- Push the exhaust system as far forward until the dimension -a- on the outer retaining loop of the front muffler is 9 to 11 mm. The -arrow- points in the direction of travel.



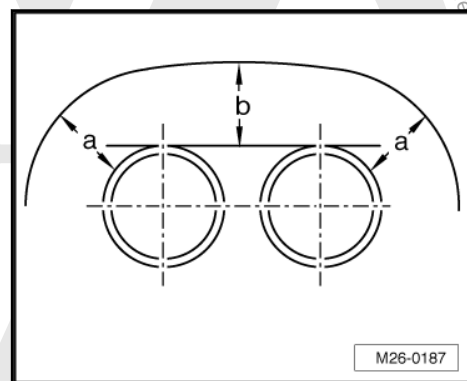
- In this position, evenly tighten the connections -3 and 4- on the clamping sleeves.



Tightening specification: 23 Nm.

#### Aligning Tail Pipe

- Align the rear muffler so distance -a- between the bumper opening and right and left tail pipes is equal.



Likewise, the distance -b- from the bumper opening to the tail pipe must be parallel.

- Loosen the rear muffler mounts to align the tail pipe, if necessary.

### 3.4 Secondary Air Injection Pump Motor-V101-

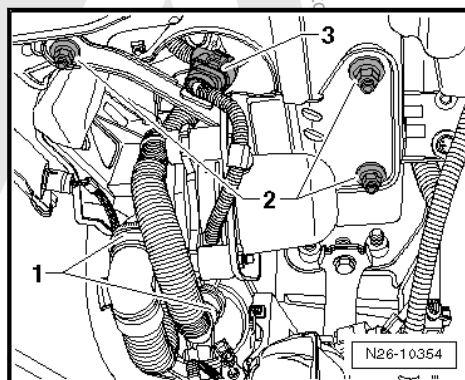
Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm -VAG1331-



## Removing

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the left front wheel.
- Remove the left front wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66; Removal and Installation.
- Loosen the lines -1-, remove the nuts -2-, disconnect the connector -3- and remove the Secondary Air Injection Pump Motor -V101-.



### Note

*Press the securing ring to disengage the lines.*

## Installing

- ♦ Tightening specifications. Refer to ➤ [-1.2 Secondary Air Injection System](#), page 440.

Install in reverse order of removal.

## 3.5 Secondary Air Injection Solenoid Valve -N112-

### Special tools and workshop equipment required

- ♦ Torque Wrench 1331 5-50Nm -VAG1331-

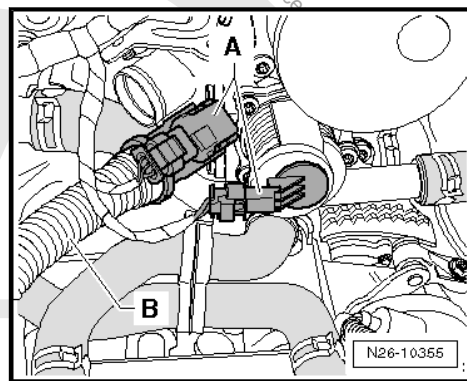
## Removing



### Note

*To perform work sequence, the battery Ground (GND) cable must be disconnected. For this reason check if a coded radio is installed. If necessary, obtain anti-theft coding beforehand.*

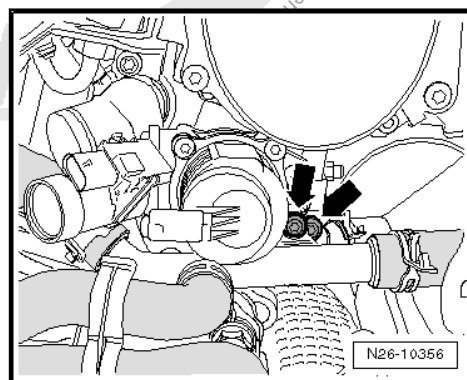
- Remove the engine cover. Refer to ➤ [C3.1 over](#), page 17.
- Remove the air filter. Refer to ➤ [F4.2 filter Housing](#), page 404.
- Remove the battery and the battery tray. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Removal and Installation.
- Remove the connector -A- and line -B- from the Secondary Air Injection Solenoid Valve -N112-.



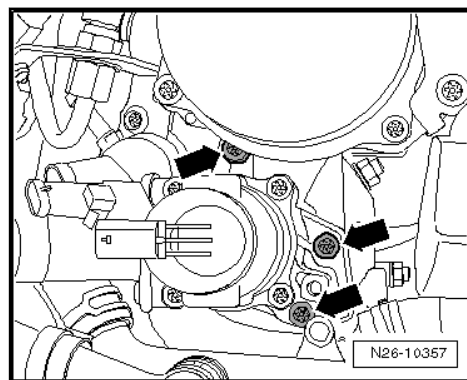
#### Note

*Press the securing ring to disengage the line.*

- Loosen the coolant pipe by removing the bolts -arrows-.



- Remove the bolts -arrows- and remove the Secondary Air Injection Solenoid Valve -N112-.



#### Installing

- ◆ Tightening specifications. Refer to ➤ [-1.2 Secondary Air Injection System-, page 440](#) , Overview - Secondary Air System.

Install in reverse order of removal. Note the following:

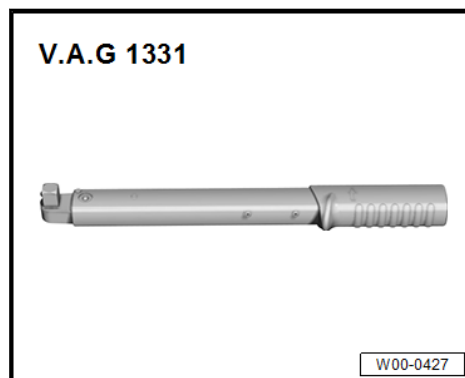
- Replace the gasket.
- Observe the notes after connecting the Battery. Refer to ➤ Electrical Equipment; Rep. Gr. 27; Removal and Installation.



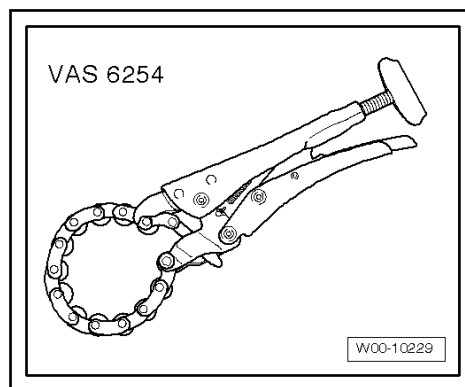
## 4 Special Tools

### Special tools and workshop equipment required

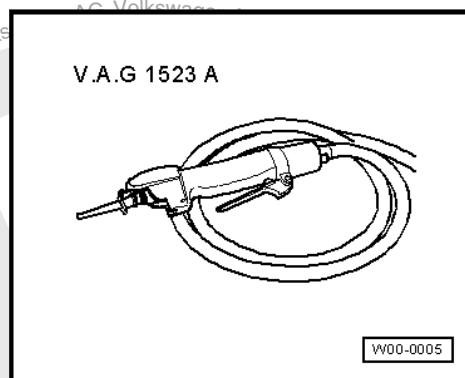
- ◆ Torque Wrench 1331 5-50Nm -VAG1331-



- ◆ Chain Pipe Cutter -VAS6254-



- ◆ Pneumatic Body Saw -VAS6780- or Body Saw -VAG1523A-





## 28 – Ignition/Glow Plug System

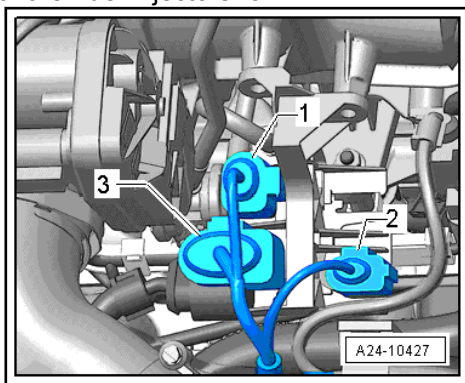
### 1 General Information

⇒ **P1.1 recautions", page 453**

#### 1.1 Safety Precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- ◆ If the engine is to be operated at starting speed without starting up the engine (for example during compression pressure test), disconnect the connector from the Ignition Coils and the 8-pin connector for the Fuel Injectors -3-.



- ◆ After performing the work, check and erase the Diagnostic Trouble Code (DTC) memory Vehicle Diagnostic Tester "Guided Functions".
- ◆ Do not touch or disconnect Ignition Coils with Power Output Stages when engine is running or turning at starting RPM.
- ◆ Only disconnect and reconnect wires for injection and ignition system, including test leads, when ignition is switched off.
- ◆ The battery must only be disconnected and connected when the ignition is switched off, or else it could damage the Engine Control Module. Obtain radio code for radios with anti-theft coding before disconnecting battery.
- ◆ Perform the necessary procedures after connecting the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27; Removal and Installation.

**If special testing equipment is required during road test, pay attention to the following:**

- Test and measuring instruments must be secured to rear seat and operated by a second person from this location.

If test and measuring instruments are operated from the front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.





## 2 Description and Operation

⇒ [-2.1 Ignition System", page 454](#)

### 2.1 Overview - Ignition System





#### 1 - Knock Sensor 1 -G61-

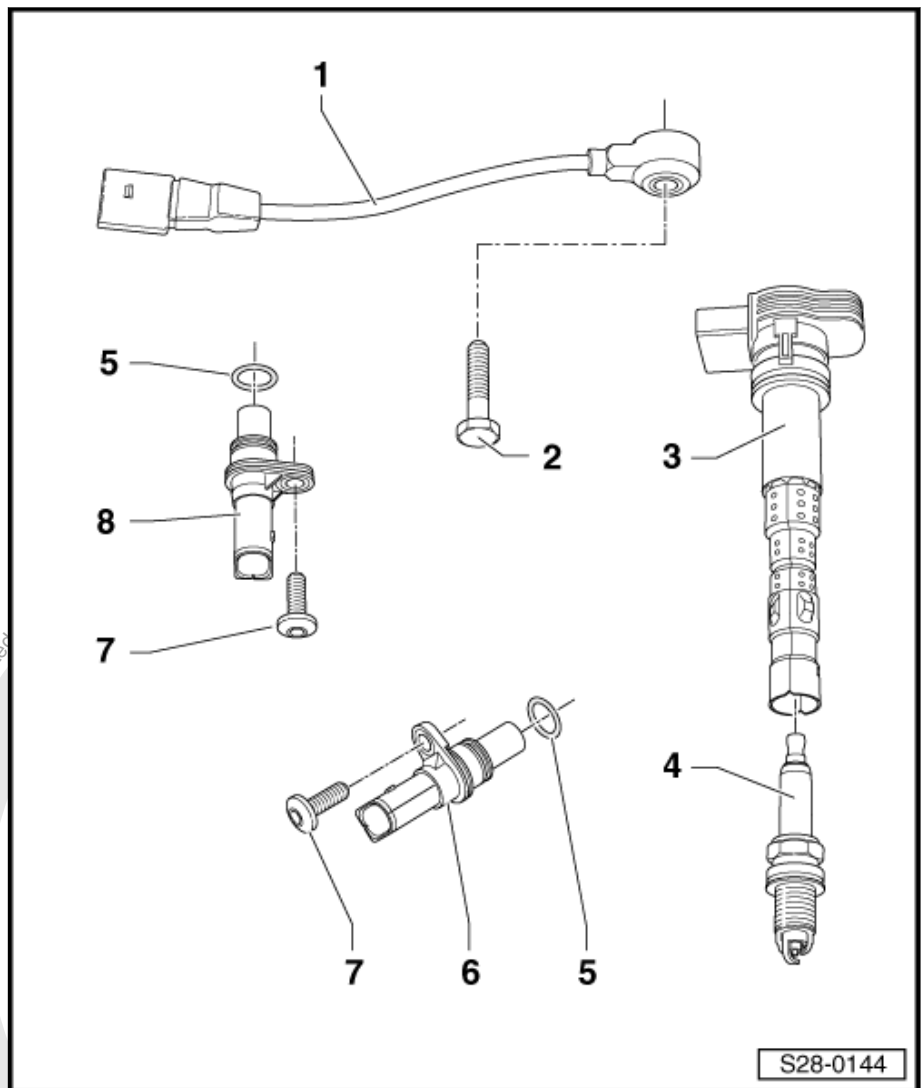
- ☐ On the front cylinder head under the intake manifold
- ☐ Contacts gold plated
- ☐ Connectors. Refer to ➤ [Fig. "Connectors", page 456](#).
- ☐ Removing and installing. Refer to ➤ [K4.3 knock Sensor 1 G61", page 460](#).

#### 2 - Bolt

- ☐ 22 Nm
- ☐ Tightening specifications affect the Knock Sensor function.

#### 3 - Ignition Coil with Power Output Stage

- ☐ Ignition Coil 1 with Power Output Stage - N70-
- ☐ Ignition Coil 2 with Power Output Stage - N127-
- ☐ Ignition Coil 3 with Power Output Stage - N291-
- ☐ Ignition Coil 4 with Power Output Stage - N292-
- ☐ Removing and installing. Refer to ➤ [C4.2 oils with Power Output Stages", page 459](#).



#### 4 - Spark Plug

- ☐ 25 Nm
- ☐ If the spark plug is replaced, grease the ignition coil with power output stage. Refer to ➤ [page 460](#).
- ☐ Note the change intervals. Refer to ➤ Maintenance Intervals; Rep. Gr. 03.
- ☐ Type and electrode gap. Refer to ➤ [D3.1 ata and Spark Plugs", page 457](#).
- ☐ Remove and install with Spark Plug Removal Tool -3122B-

#### 5 - O-Ring

- ☐ Replace if damaged.
- ☐ No replacement part

#### 6 - Engine Speed Sensor -G28-

- ☐ On the front lower left side of the cylinder block, next to the oil separator. Refer to ➤ [Fig. "Engine Speed Sensor -G28- -1- ", page 456](#)
- ☐ Removing and installing. Refer to ➤ [E4.1 ngine Speed Sensor G28 ", page 458](#).

#### 7 - Bolt

- ☐ 9 Nm

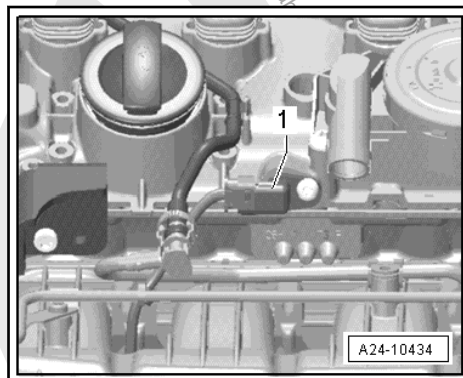
#### 8 - Camshaft Position Sensor -G40-

- ☐ Bolted on the front cylinder head cover. Refer to ➤ [Fig. "Camshaft Position Sensor -G40- -1- ", page 456](#)

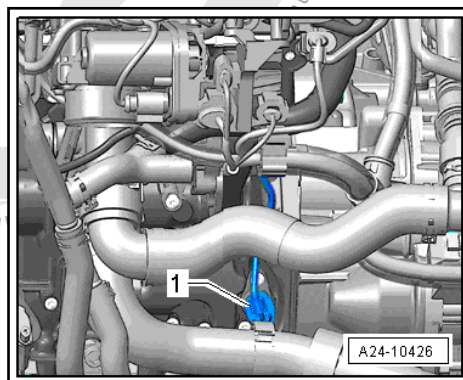


❑ Connectors. Refer to ➔ [Fig. "Connectors", page 456](#).

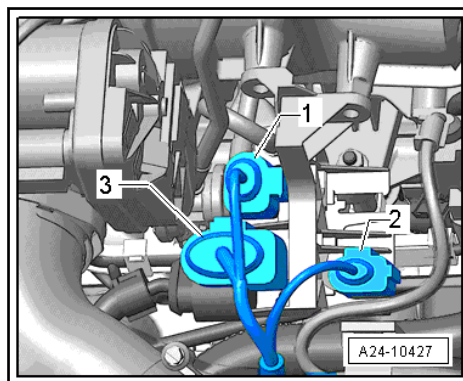
### Camshaft Position Sensor -G40- -1-



### Engine Speed Sensor -G28- -1-



### Connectors



- 1 - From Camshaft Position Sensor -G40-
- 2 - From Knock Sensor 1 -G61-
- 3 - 8-Pin Connector for Fuel Injectors



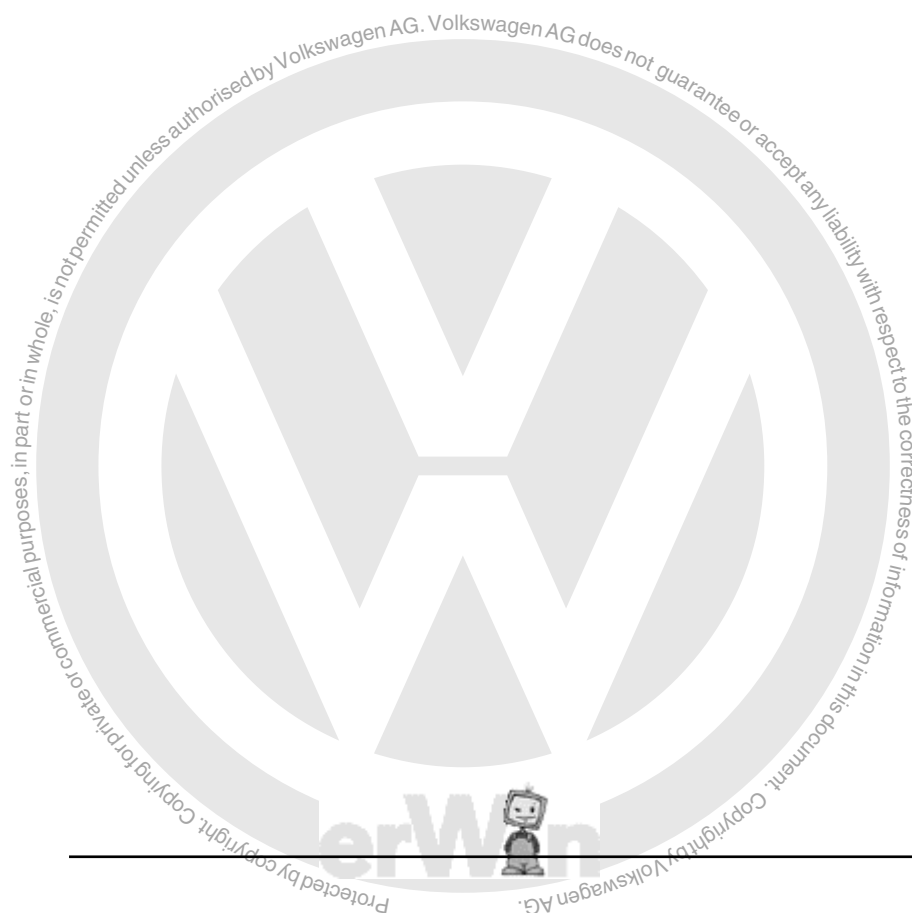
### 3 Specifications

⇒ **D3.1 ata and Spark Plugs**, page 457

#### 3.1 Test Data and Spark Plugs

Engine Codes	CBFA, CCTA
Ignition sequence	1-3-4-2
Spark Plugs <sup>3)</sup>	
◆ VW/Audi	101 905 631 H
◆ Electrode gap	1.0 to 1.1 mm
◆ Tightening Specification	25 Nm
◆ Observe change interval	Refer to ⇒ Maintenance Intervals; Rep. Gr. 03.

3) Remove and install with Spark Plug Removal Tool -3122B-





## 4 Removal and Installation

⇒ E4.1 Engine Speed Sensor G28", page 458

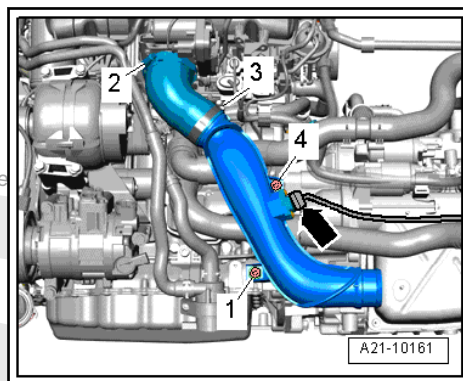
⇒ C4.2 Oils with Power Output Stages", page 459

⇒ K4.3 Knock Sensor 1 G61", page 460

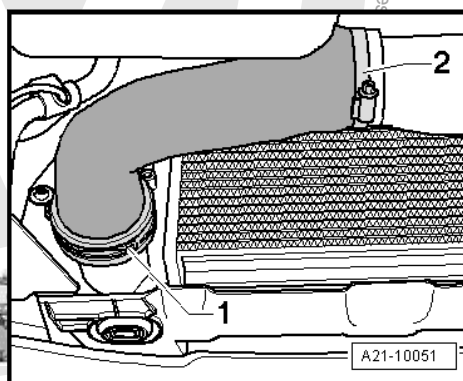
### 4.1 Engine Speed Sensor -G28-

#### Removing

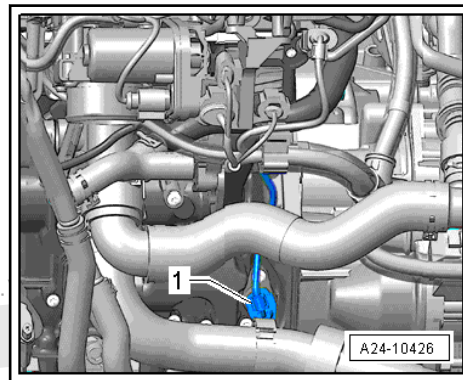
- Remove the engine cover. Refer to ⇒ C3.1 over", page 17 .
- Open the air guide pipe hose clamp -2-.



- Disconnect the connector -arrow-.
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50; Description and Operation.
- Remove the bolts -1 and 4- and remove the air guide hose downward from the Throttle Valve Control Module -J338-.
- Remove the air guide hose -1- from the charge air cooler and remove the air guide pipe downward.



- Disconnect the connector -1- from the Engine Speed Sensor -G28-.



- Remove the Engine Speed Sensor -G28- bolt.

### Installing

Install in reverse order of removal while noting the following:

- Tightening specification. Refer to ➤ [-2.1 Ignition System-](#), [page 454](#) .

## 4.2 Ignition Coils with Power Output Stages

### Special tools and workshop equipment required

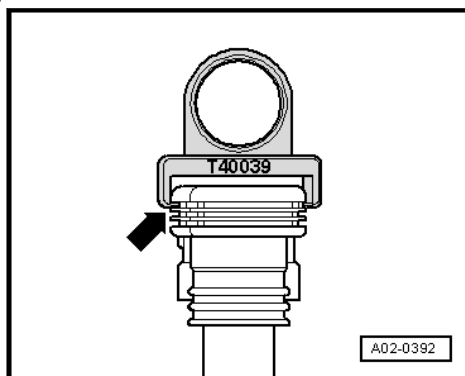
- ◆ Puller - Ignition Coil -T40039-
- ◆ Lubricating Paste -G 052 141 A2-

### Removing



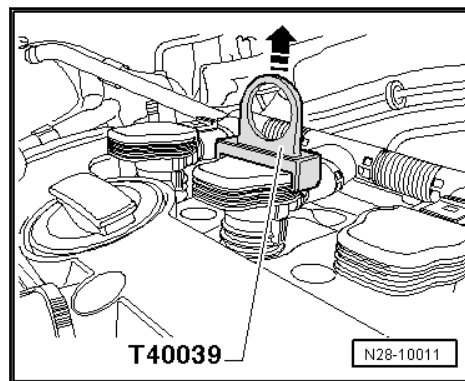
#### Note

- ◆ Follow all safety precautions. Refer to ➤ [P1.1 recuations-](#), [page 453](#) .
- ◆ Overview - ignition system. Refer to ➤ [-2.1 Ignition System-](#), [page 454](#) .
- ◆ To remove the Spark Plugs, place Puller - Ignition Coil -T40039- on topmost thick rib -arrow- of the Ignition Coil with Power Output Stage.

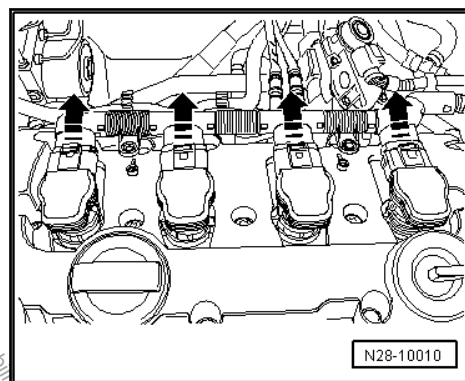


*The lower ribs may be damaged if they are used.*

- Remove the engine cover. Refer to ➤ [C3.1 over-](#), [page 17](#) .
- Pull all ignition coils approximately 30 mm out of spark plug shaft in direction of -arrow- using Puller - Ignition Coil -T40039-.



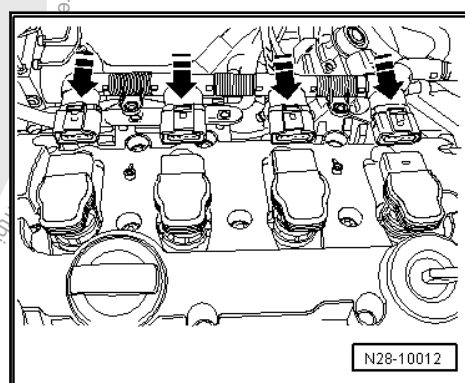
- Disconnect the connectors in direction of -arrows- from the Ignition Coils with Output Stages.



#### Install the Ignition Coils with Power Output Stages:

Insert all Ignition Coils loosely into the spark plug shaft.

Align the Ignition Coils to the connectors in direction of -arrows- and connect all connectors to the Ignition Coils at the same time.

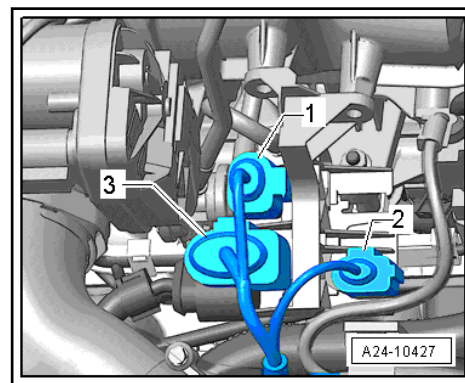


- Press the Ignition Coils evenly onto Spark Plugs by hand.

### 4.3 Knock Sensor 1 -G61-

#### Removing

- Remove the connector -2- from the Knock Sensor 1 -G61-.



- Remove the coolant pump. Refer to [⇒ P4.2 ump”, page 245](#) .



#### Note

*The Knock Sensor 1 -G61- is located below the intake manifold behind the coolant pump.*

- Remove the Knock Sensor 1 -G61-.

#### Installing

Install in reverse order of removal while noting the following:

- Tightening specification. Refer to [⇒ -2.1 Ignition System”, page 454](#) .

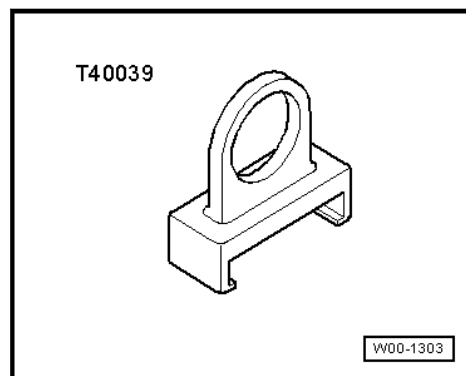




## 5 Special Tools

### Special tools and workshop equipment required

- ◆ Puller - Ignition Coil -T40039-





## 6 Revision History

DRUCK NUMBER: MEX5R008921

Factory Edition	Edit Edition	Job Type	Feedback	Notes	Quality Checked By
10.2022	11/01/2022	Factory Update	n/a		JY
02.2018	07/05/2019	Correction	n/a	Removed the druck # from the edition date tags - To prevent issues.	Eric P.
02.2018	07/02/2019	Test	n/a	Added druck # to edition date (Ausga-datum tag)	Eric P.
02.2018	03/07/2018	Local Feedback	1326503 & 1316632	Updated the Sealing Flange Transmission Side R&I.	Eric P.
02.2018	03/05/2018	Factory Update	1291691	Updated the Camshaft Timing Chain R&I.	Eric P.
02.2015	10/19/2017	Correction	N/A	Sealing Flange	Eric P.
02.2015	10/03/2017	Correction	N/A	Added notice (When replacing the coolant pump, ensure the seal, sealing surface and surrounding engine area are free from oils that may contaminate the seal and cause a repeat concern.) to Coolant pump R&I.	Eric P.
02.2015	03/27/2017	Local Feedback	1238873	Updated Valve Timing, Checking procedure	Eric P.
02.2015	2/24/2015	Factory Update			Jim H.
	10/15/2011	Local Feedback	1044690		Eric P.

# Cautions & Warnings

**Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.**

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the Volkswagen Factory Approved Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

## Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.
- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

## Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the Volkswagen Factory Approved Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

**I have read and I understand these Cautions and Warnings.**

